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ORTHOPEDIC SURGERY · GYNECOLOGY

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May 1948

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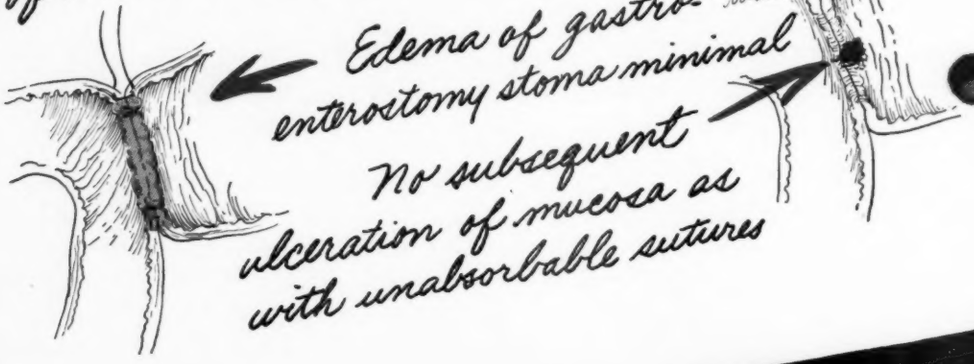

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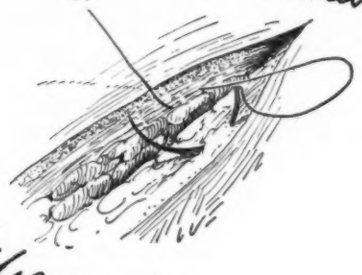

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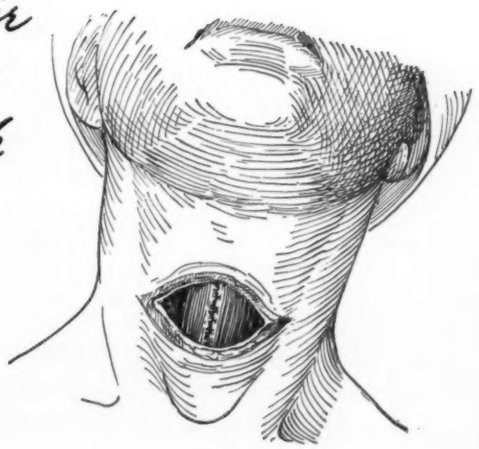

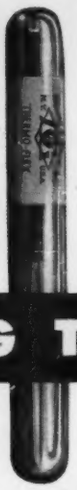

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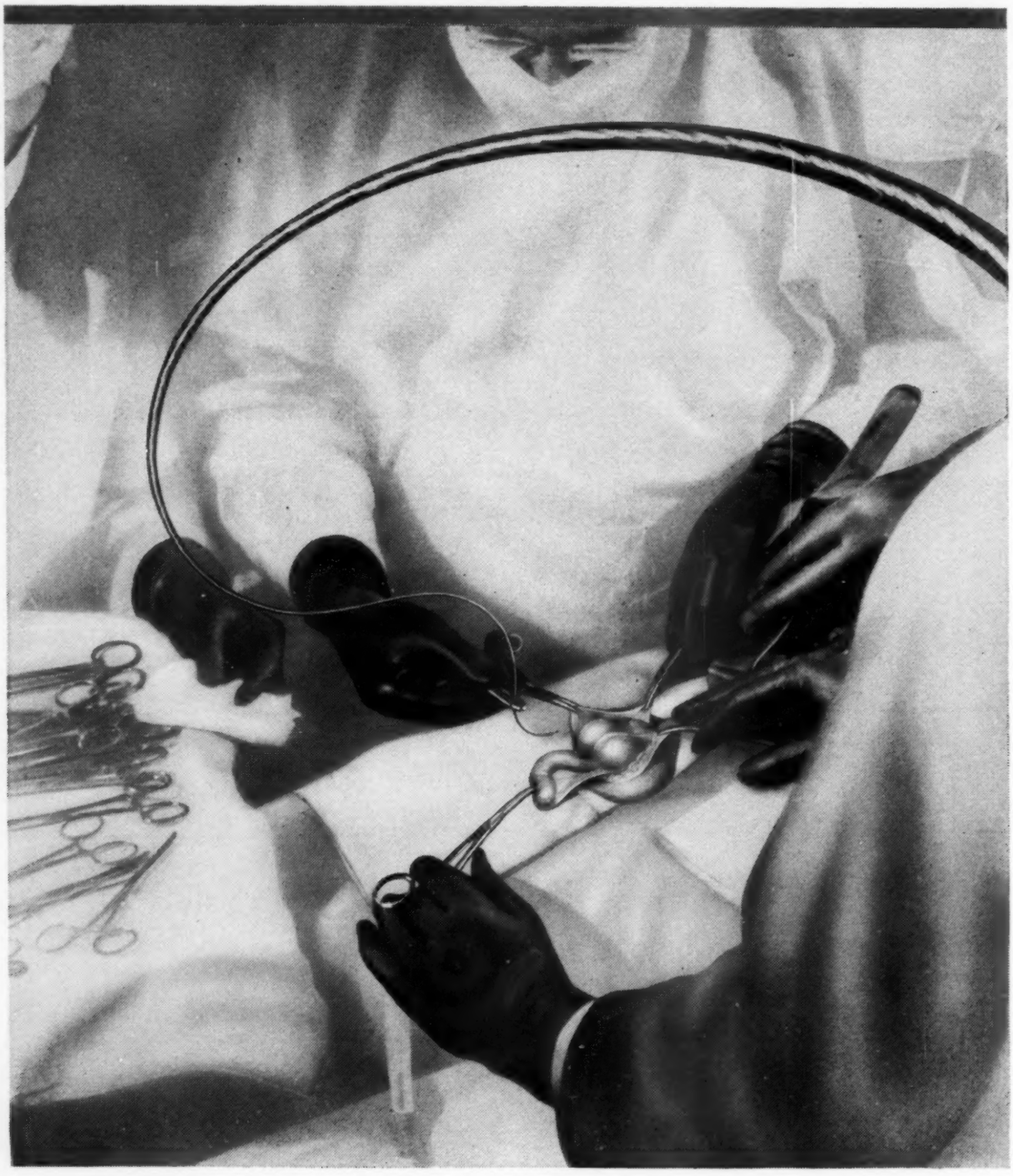

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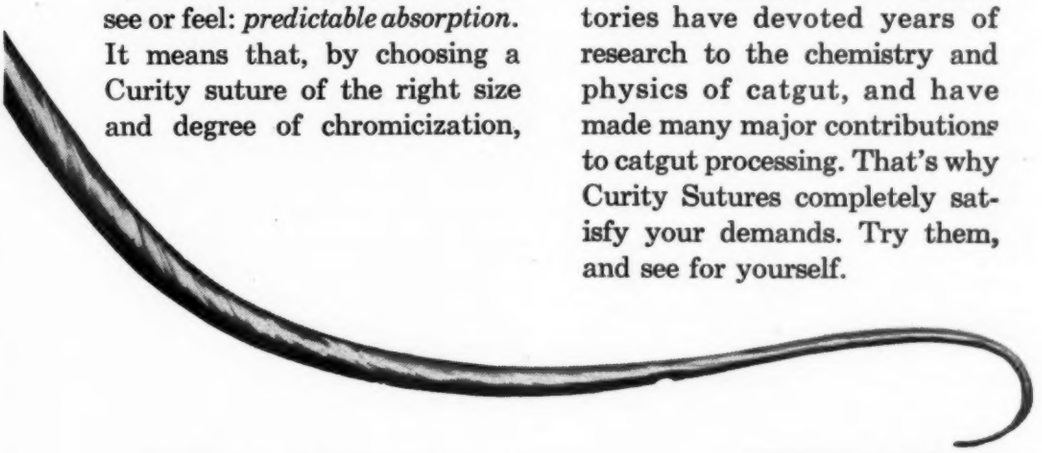

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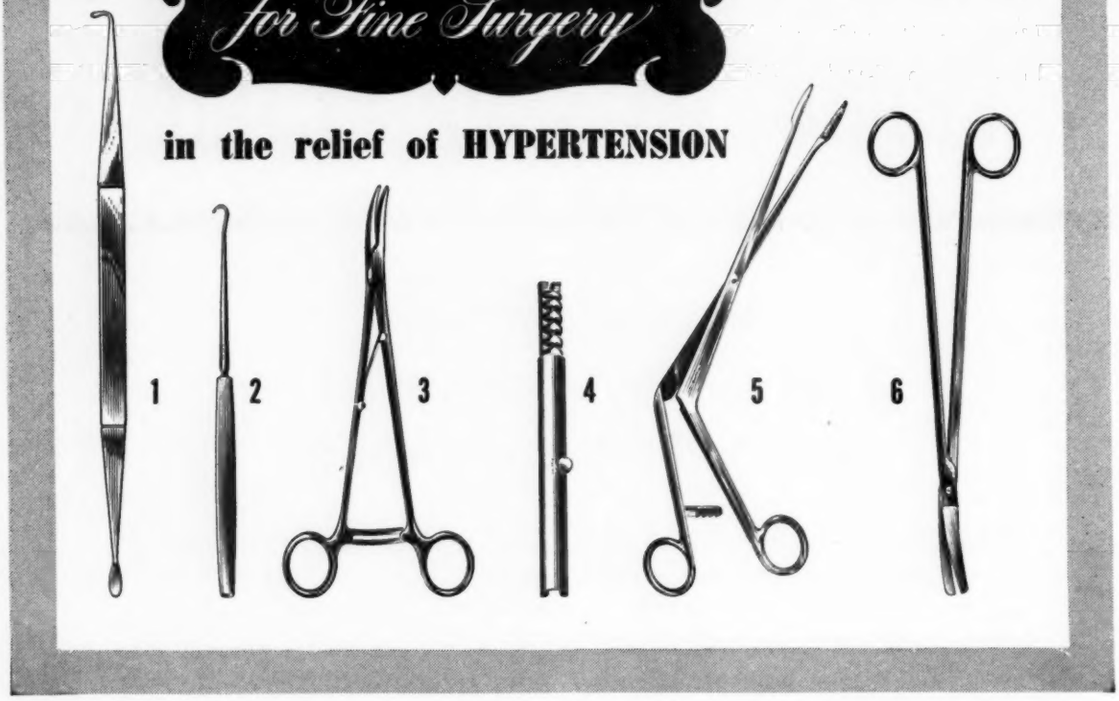

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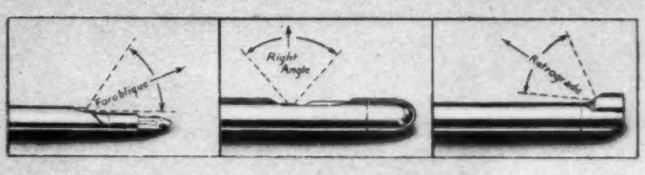

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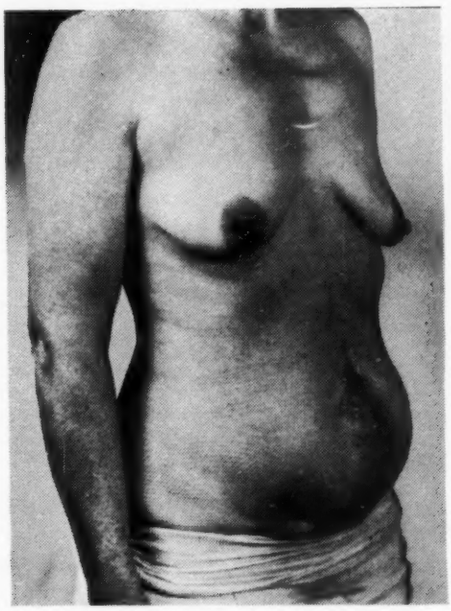

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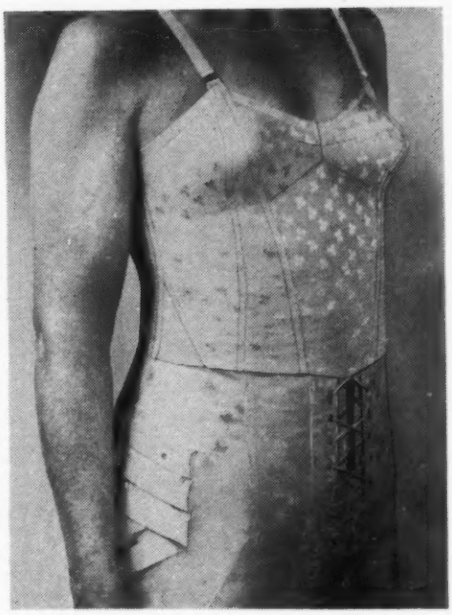

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Outside the Ivory Tower

DR. LOUIS K. DIAMOND, authority on hematology and assistant professor of pediatrics at Harvard Medical School, Boston, has been appointed technical director of the American Red Cross National Blood Program, Dr. Ross T. McIntire, administrator of the program, has announced. Dr. Diamond will plan and supervise technical phases of the new program, designed eventually to provide blood and blood derivatives to the entire nation without charge for the products. In 1942, when the first large scale blood grouping laboratory was established to study the Rh factor at Children's Hospital, Boston, Dr. Diamond became its director. He did the original research on the technic of replacing the blood of infants afflicted with erythroblastosis. During the war Dr. Diamond conducted research in the clinical uses of blood, working with the National Research Council through the Office of Scientific Research and Development.

THE following resolution was passed unanimously by the Southern Surgical Association: "Although the Southern Surgical Association has been and always will be extremely interested in the advancement of all medical sciences, and particularly in anesthesia because of complete dependence on safe anesthesia for the safe performance of a surgical procedure, it, the Southern Surgical Association, heartily disapproves of the publicity given by certain newspapers and popular lay magazines to the statement sponsored by a group of anesthesiologists who are seeking to discredit the well trained nurse anesthetist and to compel surgeons to operate only if anesthetics are administered by physician-anesthetists. This attempt to persuade the public that there is a grave danger in a surgical operation if the anesthetist is not a certified medical specialist is already decreasing the number of efficient well trained nurse anesthetists and forcing surgeons to perform recently developed complicated operations with anesthetics administered by young hospital interns or general practitioners, neither of whom have special training or experience in the administration of an anesthetic."

SIXTEEN young scientists have been appointed as the first group of Scholars in Medical Science, under the plan announced last fall by the John and Mary R. Markle Foundation to support qualified young scientists who wish to make a career in academic medicine. The scholars were selected from candidates nominated by accredited medical schools in the United States and Canada by regional committees appointed by the Foundation. Toward the support of the scholars and their research the Foundation has allocated a total of $400,000 to their respective medical schools, each school to receive $25,000 payable at the rate of $5,000 annually for five years. As faculty members of the participating medical schools, the scholars will devote the next five years to teaching and research, at the end of which time they will have had an opportunity to become established teachers and investigators.

The following are the sixteen scholars whose appointments begin in 1948: Christian B. Anfinsen, PH.D, Harvard Medical School; Henry H. Balch, M.D., Dublin University School of Physicians; Edward J. Beattie, Jr., M.D., Harvard Medical School; Marcel E. Blanchaer, M.D., Queen's University Faculty of Medicine; Ivan W. Brown, Jr., M.D., Duke University School of Medicine; Robert H. Ebert, M.D., University of Chicago School of Medicine; Richard C. Fowler, M.D., University of Rochester School of Medicine and Dentistry; Henry D. Hoberman, M.D., Harvard Medical School; Ralph A. Kinsella, Jr., M.D., St. Louis University School of Medicine; Christian J. Lambertsen, M.D., University of Pennsylvania; William D. Lotspeich, M.D., University of Cincinnati College of Medicine; Preston B. Lowrance, M.D., University of Virginia Department of Medicine; Frederick D. McCand-

(*continued on page 20*)

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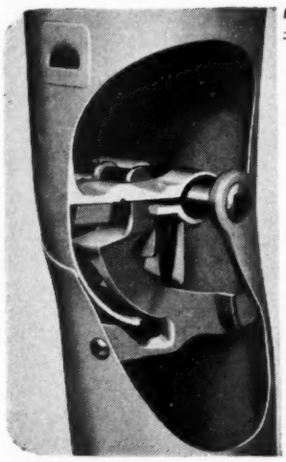

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Outside the Ivory Tower

(*continued from page* 18)

less, M.D., Cornell University Medical College; Manson Meads, M.D., Temple University School of Medicine; Julius B. Richmond, M.D., University of Illinois College of Medicine; Ralph O. Smith, M.D., University of Chicago School of Medicine.

PLANS for a $10,000,000 development of the Philadelphia Medical Center at the University of Pennsylvania Medical School and Hospital, designed to give Philadelphia one of the nation's outstanding centers for medical education, research, preventive medicine and care of the sick, were made public by officials of the University, its Medical School and the University Hospital. At the same time a conditional contribution of $1,000,000 from the Donner Foundation, Inc., toward the development of the Medical Center was announced. This gift is to go toward construction of a Group Diagnostic Out-Patient Clinic and is conditioned upon the University's starting construction of an out-patient building by May, 1949.

ALMOST all the States shared in a general decline in mortality between 1945 and 1946, according to a statement released by Federal Security Administrator Oscar R. Ewing summarizing figures of the National Office of Vital Statistics, U.S. Public Health Service. The national crude death rate decreased from 10.6 in 1945 to 10.0 in 1946, and in all but six of the individual States the rates for residents also decreased between these years. Increases were seen for: the District of Columbia (which rose from 9.6 in 1945 to 9.8 in 1946), Florida (from 9.8 to 10.0), Idaho (from 9.4 to 9.7) and Mississippi (from 9.1 to 9.2). New Mexico and South Dakota had the same death rate in both years (10.3 and 10.1, respectively).

THE National Gastroenterological Association will hold its Thirteenth Scientific Session at the Hotel Pennsylvania in New York City on June 7–10, 1948. Further details and a copy of the program may be obtained by writing to the Secretary, National Gastroenterological Association, 1819 Broadway, New York 23, N.Y.

THE 1948 edition of "Facts and Figures about Infantile Paralysis," a publication of

(*continued on page* 22)

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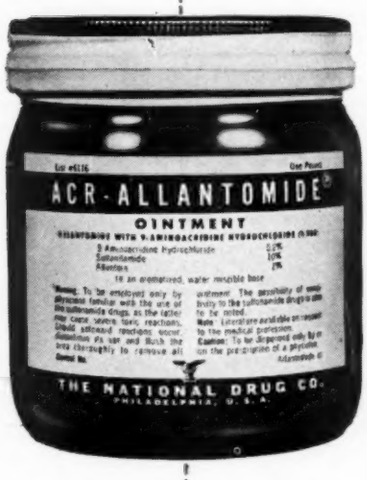

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[1] Martin, G. J. & Moss, J.: Proc. 111th Meeting A. S. C., p. 2B. Atlantic City, N. J. (April 14-18) 1947.

[2] Spotts, S. D.: Am. J. Surg. 2:183 (Aug.) 1947.

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Outside the Ivory Tower

(*continued from page 20*)

the National Foundation for Infantile Paralysis, is now available to physicians and public health workers. Statistics on the disease, revised yearly, are gathered from the United States Public Health Service, state health departments and various other sources. Incidence of infantile paralysis in the United States is shown in tables, maps and charts. Other statistics furnish information on age and sex distribution, case rates, crippling conditions and mortality. For the first time this publication includes data on the disease in foreign countries. Copies of the booklet (No. 59) may be secured free of charge by writing Education Service, The National Foundation for Infantile Paralysis, 120 Broadway, New York 5, N.Y.

THE American Society for the Study of Sterility is holding its Fourth Annual National Session on June 21 and 22, 1948, at the Congress Hotel in Chicago. Additional information may be obtained from the secretary, Dr. John O. Haman, 490 Post Street, San Francisco 2, Calif.

THE award of two new Sharp and Dohme research grants and the renewal of five others was announced today by Dr. L. Earle Arnow, Director of Research of the Philadelphia drug manufacturers. One of the new grants was made to the Philadelphia General Hospital to be administered under the direction of Dr. Pascal Lucchesi. It is to provide technical assistance for conducting clinical studies and assays on certain antibiotics, including penicillin. The other new grant was awarded Southwestern Medical College in support of work by Dr. W. Lee Hart who has been conducting extensive studies on pertussis agglutinogen, the new laboratory agent used to determine the amount of protection against the pertussis bacillus.

DICRAN A. BERBERIAN, M.D., formerly chairman of the department of bacteriology and parasitology at the American University of Beirut, Lebanon, is now a senior investigator in the department of chemotherapy of the Sterling-Winthrop Research Institute, Rensselaer, N.Y. Dr. Berberian is also an assistant professor of medicine at Albany Medical School where he is lecturing on treatment of tropical diseases.

I've been so busy detailing hot items like our Immune Serum Globulin and Hypertussis in my last few columns, I darn near overlooked my promise awhile back to let you have that story on old maids and I.V. solutions.

What reminded me of all this was a recent article by Rademaker* on pyrogenic reactions from intravenous solutions. Says he:

"Pyrogenic reactions from intravenous solutions remain a problem in many hospitals although the means to eliminate them entirely are well known. Immediate sterilization after proper distillation will eliminate pyrogen from solutions, provided that glass containers are similarly sterilized after cleansing and rinsing with distilled water."

If you're still making your own solutions or re-using injection equipment, Doctor Rademaker's article gives full details on all the steps necessary in trying to make certain that solutions, bottles, tubing and connections are sterile and pyrogen-free. He emphasizes, however, that there's still no assurance without adequate testing every step of the way. A much easier, more dependable method — it seems to me — is simply to count on the "old maids" at Cutter.

Fussier, crankier characters you've never seen when it comes to making safe solutions. Production bends over backward. Then the testing staff does its best to break their backs by putting solutions to the same safety tests set up for vaccines and serums—plus some more they've dreamed up just for solutions. It adds up to a tough life at the Lab — but an easier one for you and your patients. And the expendable equipment you get from Cutter now does even more to fill the requirements set down by Rademaker.

If you were expecting my old maid story to be a funny one, sorry to disappoint you. But in my book, pyrogens just "ain't funny."

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* *Rademaker, Lee: Reactions to Intravenous Administration of Solutions, J.A.M.A. 135:17:1140-1141: 12-27-47.*

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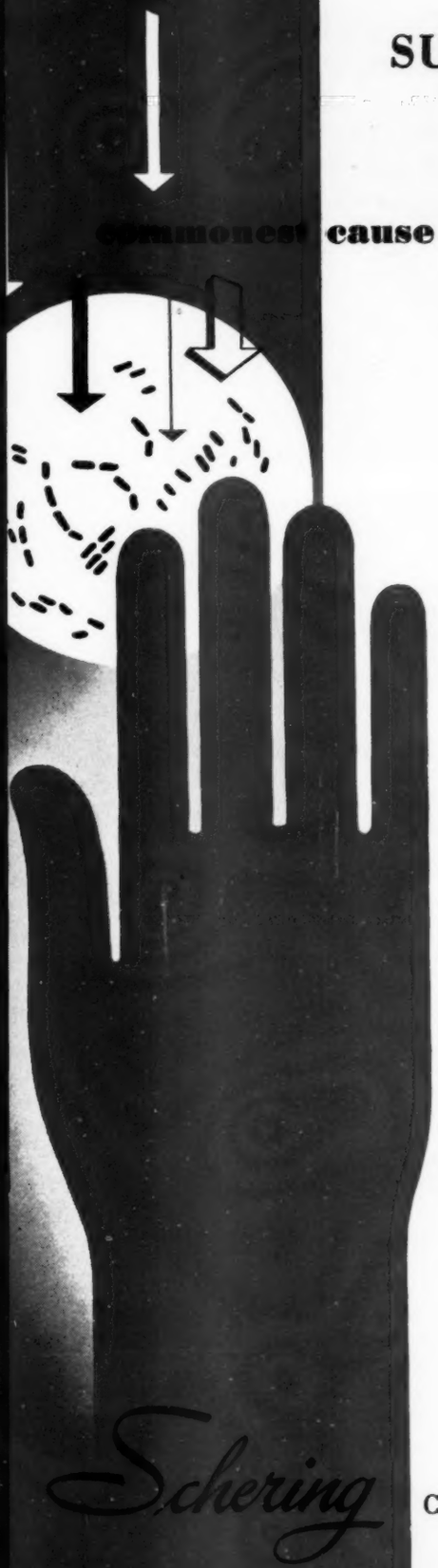

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BIBLIOGRAPHY: (1) Wesson, M. B.: West. J. Surg. **49**:662, 1941. (2) Welebir, F., and Barnes, R. W.: J.A.M.A. **117**:2132, 1941. (3) Younge, P. A.: Urol. & Cutan. Rev. **49**:422, 1945. (4) Kearns, W. M., in discussion on Herrold, R. D.: Wisconsin M. J. **41**:467, 1942.

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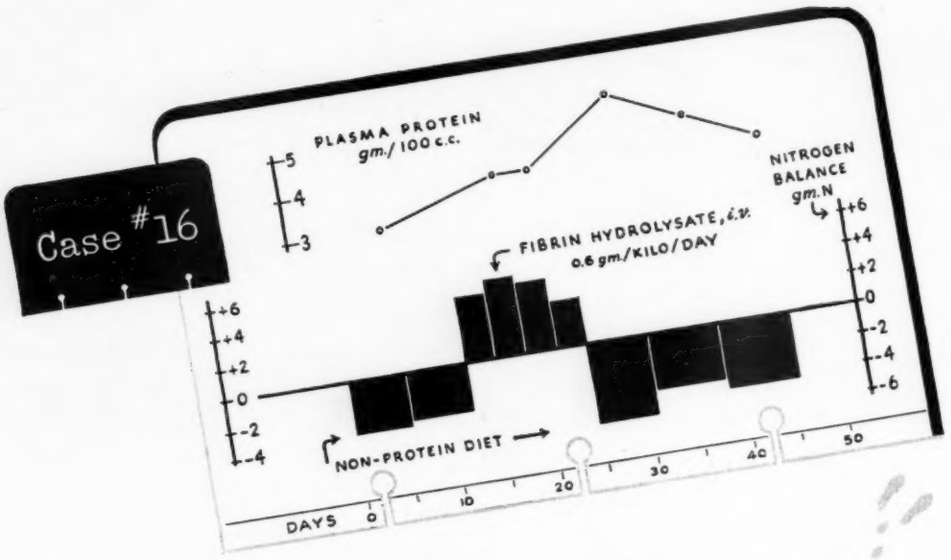

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1. Frost, D. V., Heinsen, Jean, and Olsen, R. T. (1946), Arch. Biochem., 10:215, June. 2. Christensen, H. N., Lynch, E. L., Decker, D. G., and Powers, J. H. (1947), The J. Clin. Invest., 26:849, September. 3. Barborka, C. J., Carroll, W. W., and Hepler, O. E. (1947), Gastroenterology, 9:579, November.

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Gallbladder	1.96	1.24	37.7
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Gynecologic	1.90	1.47	22.6
Intestinal and Stomach	2.33	1.82	21.9
Appendectomy	1.44	1.31	9.9
Herniorrhaphy	1.81	1.88	+ 3.8
		AVERAGE	26.3

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1. Troup, G. R.: M. J. Australia 34:259 (Aug. 30) 1947.
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4. Baird, J. W.: Anesthesiology 8:75 (Jan.) 1947.

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1. New England J. Med. 213:279

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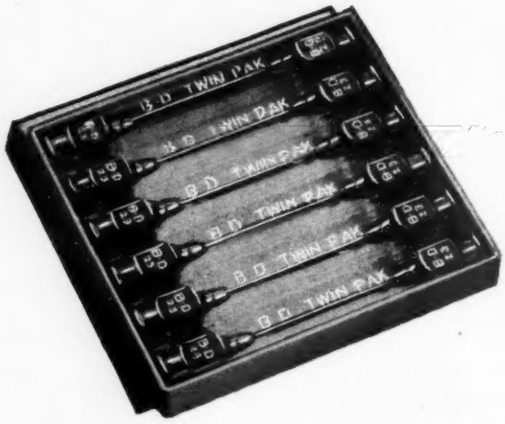

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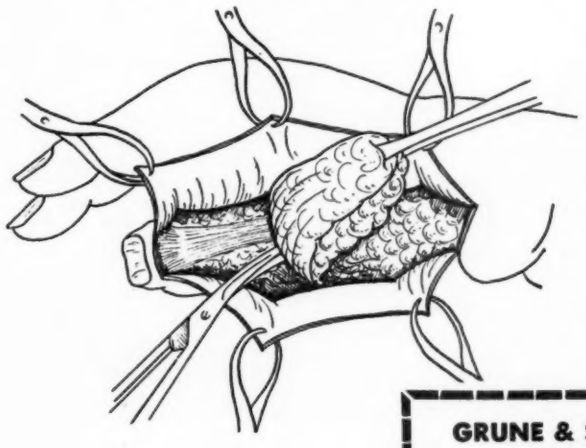

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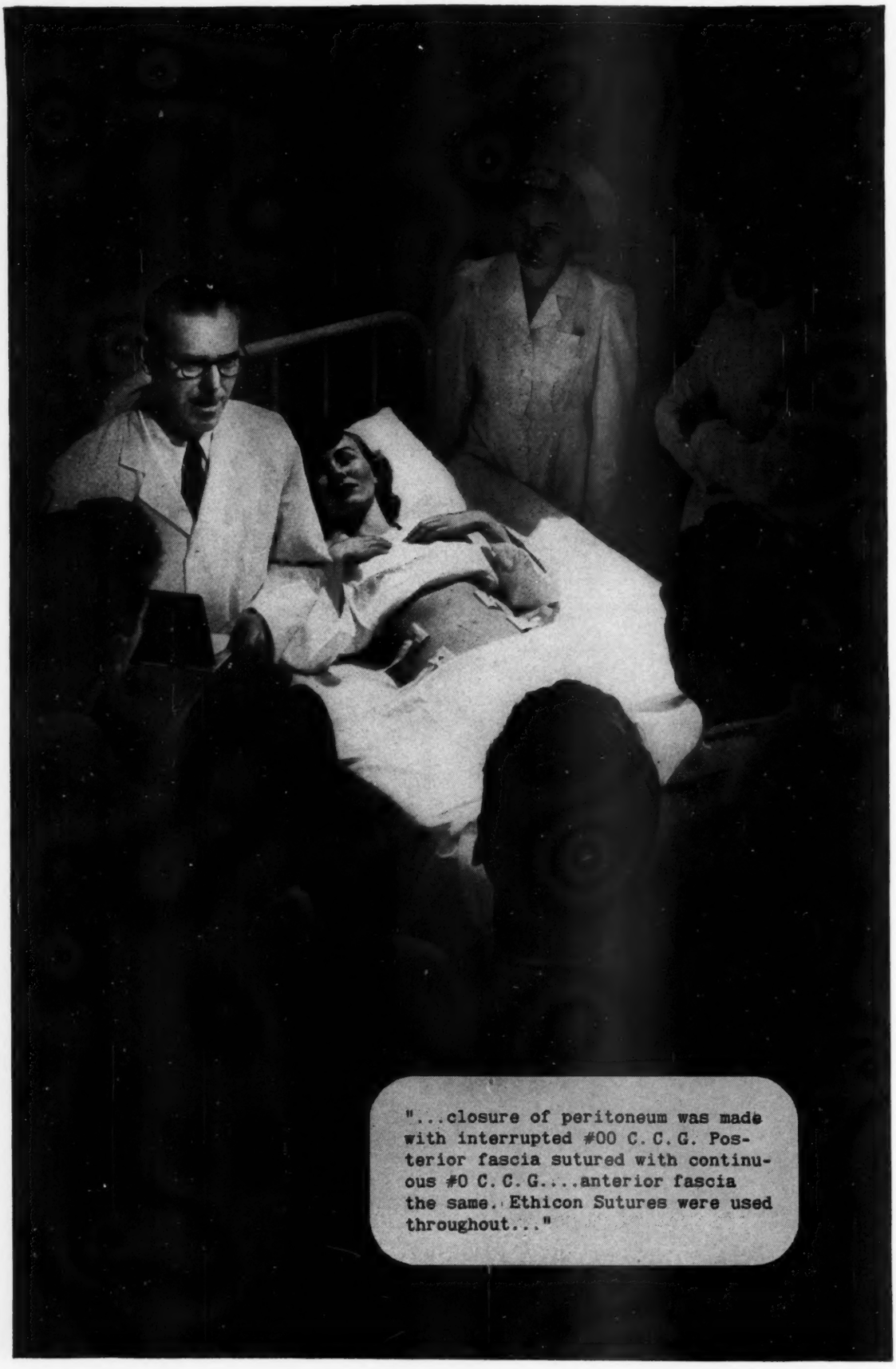
"...closure of peritoneum was made with interrupted #00 C. C. G. Posterior fascia sutured with continuous #0 C. C. G....anterior fascia the same. Ethicon Sutures were used throughout..."

The American Journal of Surgery

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A PRACTICAL JOURNAL BUILT ON MERIT

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VOL. LXXV MAY, 1948 NUMBER FIVE

Editorial

WOUND HEALING AND NOSTRUMS

ACCORDING to a standard dictionary, a nostrum is "a medicine recommended by its preparer, especially a quack medicine." Nostrums can be divided into two classes, those which are recommended by their preparers directly to the consuming lay public and those which are recommended to a middle man, the physician. In the first classification may be found such boons to mankind as reducing salts, bust developers, alcohol repellents to be put in coffee and pills to cure self-diagnosed kidney trouble. The outstanding example of a nostrum in the second group is the proprietary preparation which is alleged to affect favorably the healing of wounds.

A little reflection will show why it is that the nostrum preparer has found such green pastures in the field of wound healing. He is continually favored by the strong biologic tendency of the body to heal itself. In particular, small incised wounds and minor burns are quite apt to heal regardless of what is done for them.

Let us consider the steps in the development of a market for a new burn ointment. It is only necessary to select a jelly or grease base which is not definitely harmful and which does not produce pain when applied locally. To this is added minute quantities of the factor for which therapeutic properties are claimed, after which it is neatly packaged in tubes or jars. Before the product can be sold permission must be obtained from the agency administering the U.S. Pure Food and Drug Law. For this it is necessary to secure a number of case reports from physicians who have tried the ointment. Therefore, a few hundred pounds of the product are shipped to doctors who conduct what is later referred to in the advertising brochures as "painstaking clinical research." The ointment is applied to some second degree burns which heal in a week or two, and the observers are likely to be of the impression that the progress of the lesions was somewhat better than had been observed with other methods of treatment. The preparer gathers up these case reports, presents them to the government agency, and sooner or later gets the nod that the marketing may begin. The commercial phase of the process will be facilitated by the publication of the case reports in an article entitled "A New Treatment for Burns: A Clinical Study of 49 Cases." Reprints of the article can be sent along with the more colorful promotion material.

The sequence of events just described must have been repeated many times because a great number of burn remedies are on the market. Several years ago a study was made of the methods of treatment of minor burns in three large industrial con-

cerns. It was found that in the care of 5,609 burns, 84 different substances were used. Fifty-seven of these carried the brand names of their preparers. Statistics on the days required for healing showed that it made no difference what was put on these minor burns; if there was an advantage, it was with the simple non-medicated preparations.

The basic defect in the so-called clinical research on substances used for the treatment of wounds is that controls are usually lacking. It may be assumed that in the hypothetical paper mentioned above all the forty-nine patients were treated in the same way, with the new ointment. The proper approach would have been to treat the alternate patients with a presumably inert substance. In all probability the results would not have been statistically significant but if several other investigators were to publish similar controlled studies, the aggregate of all of the reports might provide a basis for real evaluation.

There are several more or less standard types of wound healing experiments which are available to make critical tests of substances for which claims of stimulation of healing are made. Small, symmetrical cutaneous wounds can be made in the guinea pig; the substance to be investigated is placed on one wound and nothing is placed on the other. No agent has been found which will consistently cause the treated wound to heal more rapidly than the control. In the human a convenient test wound is the dermatone donor site where wounds of the same size and depth may be made on symmetrical areas of the body. Again, there is no report of a substance which will accelerate the healing of this partial thickness wound.

A few years ago a popular news magazine reported a "New Burn Cure." The preparer, appraising his nostrum, had stated for the record that the research work in connection with the new treatment would "go down in history as second to none other, including the work of Pasteur." Although controlled wound healing experiments by individuals other than the preparer have shown that the ointment has no action not possessed by plain petrolatum, the advertising copy still mentions "Acceleration of rate of healing and epithelization":

Conrad R. Lam, M.D.

Original Articles

TREATMENT OF FRACTURES OF LONG BONES BY OPEN REDUCTION AND SCREW FIXATION*

A REPORT OF FORTY-TWO CASES

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IT is the purpose of this paper to report on the successful treatment of forty-two fractures of long bones by operative reduction and screw fixation. In the majority of these fractures the ends of the fragments were without sufficient serrations or the displacing muscle forces were too strong to permit obtaining satisfactory reduction and control of the fragments by the routine manipulative and plaster fixation method. Because of the disadvantages and inadequacies of the popular traction procedures, this form of treatment was not considered, and in a few cases that came late to the author's attention traction had already proved to be unsuccessful. Screws were preferred to plates for fixation material because of the ease of execution of screw fixation and the adaptability of screws to different types of fractures as well as to fractures in the region of joints.

DISADVANTAGES OF TRACTION METHODS

Among the requisites of balanced suspension traction is constant supervision in order to ensure the maintenance of the fragments in correct position. This is a drawback to the method since it is often difficult to provide for such supervision, especially when fractures are treated in distant hospitals and can be inspected only periodically, as was true of many cases in this series. Furthermore, this balanced traction method calls for prolonged hospitalization and an extended period of discomfort and inactivity, particularly in fractures of the lower extremity.

Another limitation of both weight traction and double pin traction methods, which is being recognized more and more, is distraction of the fractured surfaces. This is a factor most inimical to the production of callus. Even a minimal amount of separation between the main fragments is sufficient to cause a delay in healing. The distraction is usually the result of overpulling the fragments in an attempt to obtain close apposition and alignment. When the fracture is of the spiral type and distraction is present, the line of thrust is shunted out on both sides instead of up the center of the bone along the normal line of thrust, thereby retarding the formation of callus.

With the use of traction an angulation of the fragments is likely to occur which, in turn, causes an uneven distribution of callus and delayed union. Slow healing due to angulation is seen in fractures of the femur with bowing in which callus forms in the concavity of the bow but not on the convex side.

ADVANTAGES OF SCREW FIXATION

The open method which provides effective rigidity offers a much safer course of treatment than traction, when the patient cannot be under the operator's supervision following the reduction of the fracture. Only a minimal period of hospitalization is

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required following screw fixation. After the initial swelling has subsided in a few days the patient has no complaint. In the average case of a fracture of the femur that has been transfixed the patient is out of bed within a few days and may be discharged from the hospital within two weeks. Since the average period of hospitalization for a fractured femur treated by traction is eleven weeks, the economic loss is cut considerably. From the surgeon's standpoint the reduction of the period of hospitalization is a "must" in these days when hospital beds are at a premium.

Provided the technic of transfixion is carried out precisely, there is no danger of distraction of the fractured surfaces. Healing at a normal rate is ensured because the complete and accurate fixation provides for the transmission of the line of thrust along the normal line of thrust. Early weight-bearing may be permitted following screw fixation, which helps to prevent atrophy of the soft tissues, and by increasing the circulation favors the formation of callus. Moreover, the patient's morale is improved when early weight-bearing is possible.

The drawback to screw fixation lies in subjecting the patient to the danger of infection incident to operative treatment. This risk is negligible if the surgeon is competent and provided the operation is carried out in a well equipped and well organized hospital. No sepsis was encountered in the forty-two cases being reported.

INDICATIONS FOR INTERNAL SCREW FIXATION

In the author's opinion screw fixation is not to be recognized as the routine primary treatment for all fractures of the long bones. In general, operative indications are recognized in fresh oblique, spiral or comminuted fractures of the simple or compound type in which manipulative treatment would be ineffective. These are cases in which the serrations of the fractured ends do not permit locking of the fragments or in which strong muscle forces tend to maintain the fragments in displacement. In such cases screw fixation should be carried out as the initial method of treatment and not reserved as a method of last resort, because the delay in its use may jeopardize the chances of a favorable outcome.

Screw fixation is indicated when manipulative or traction methods have been tried and failed. It is a satisfactory method of treating fractures of long standing that remain ununited or malunited following the use of other methods.

The compound fracture in which a débridement leaves the fractured area widely exposed presents ideal conditions for carrying out a transfixion. If the surgeon is competent and chemotherapy is used, early internal fixation in the open wound is a safe procedure. Union tends to take slightly longer in compound fractures than in closed injuries treated by screw fixation.

Special indications for screw fixation may be presented by certain cases that might likewise be handled satisfactorily by manipulative measures. In fractures of the shaft of the humerus the complicated retentive dressing or apparatus that must be worn following manipulative reduction is uncomfortable for an obese patient. Operative screw fixation, which requires only a minimum of external support, has special application to such cases.

Some patients prefer operative treatment in order to shorten the period of hospitalization. For instance, in the series of cases herewith reported there was a patient who had been injured far from home and it was naturally his desire to be ambulatory as soon as possible.

Special indications for operative fixation were presented in an unusual case in the series being reported. The fracture was situated in the upper part of the femur and the patient's leg on the same side had previously been amputated above the knee. Screw fixation was necessary to hold down the distal fragment which in its position of displacement upward and medially would

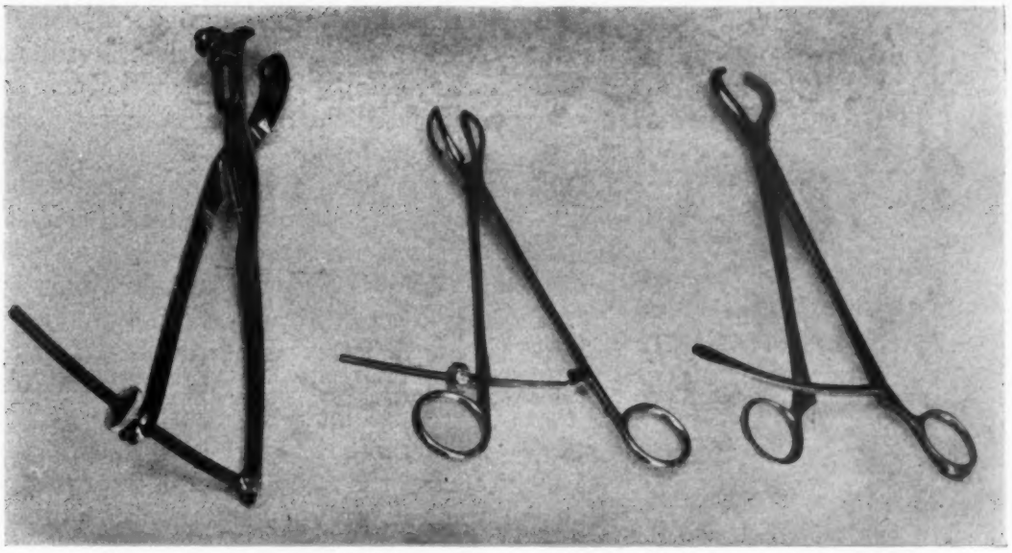


Fig. 1. Clamps used to hold fragments in position while screws are introduced.

prevent the patient from wearing an artificial leg.

It is understood that the general surgical indications of age, physical and local conditions must be favorable. The presence of blebs is not a contraindication to screw fixation even when the incision must be made in the bleb area. The formation of blebs, as well as swelling, may be prevented to some extent by bandaging the limb immediately after the injury. Screw fixation is not contraindicated in the child.

OPERATIVE PROCEDURE

Time of Operation. In closed fractures the operation is best performed within one week of the injury and the optimal time is four days. In the interval the original hemorrhage will have become stationary, the blood channels sealed over and the circulation stabilized. Also, an opportunity is provided to evaluate the damage to the soft tissues, nerves and vessels.

In compound fractures a débridement, followed by reduction and fixation, should be carried out immediately after the fracture.

Technic. The operation is carried out under rigid aseptic technic. In the simple fracture, after the skin has been prepared and the limb draped, a skin incision adequate to provide good exposure is made over the fractured area. In the case of a compound fracture a thorough débridement is first carried out.

The muscles are separated by sharp dissection, wherever possible, and allowed to fall back. Care is taken not to traumatize muscles that are split and engorged with blood. Wet gauze is used under retractors. The nerves and vessels in the proximity of the operative area are visualized and retracted if necessary. The periosteum of the main fragments is split and stripped subperiosteally wherever possible, care being taken to preserve all soft tissue attachments.

The pointed ends of the fragments are dulled in order to facilitate the approximation of the bones and to avoid damaging the soft parts. The danger of tearing gloves is also avoided by blunting the fractured ends. The fracture is reduced and the fragments are held in position by means of one or more special clamps. (Fig. 1.)

The mechanical problem is then studied. The screws when introduced should engage an equal amount of bone in each fragment as well as the cortex of each fragment. Fragments must be carefully approximated to ensure the transmission of the thrust along the normal line of thrust. The screws must be so placed that they lie as nearly as possible at the right

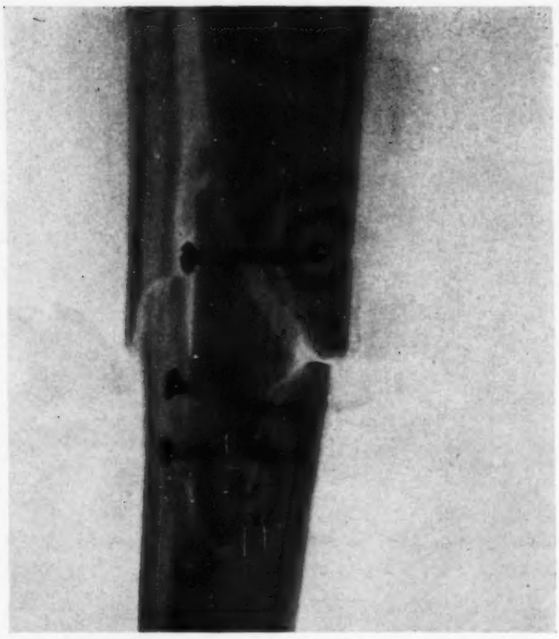


FIG. 2. Roentgenogram showing the distraction that may occur when screws are not placed properly.

angle to the line of fracture, thereby taking care of the stress in different directions.

The proper placing of the screws is extremely important. Figure 2 illustrates a case in which distraction occurred as the result of poor technic. The conformation of the fragment ends in this case was such that when the screws were tightened the fragments spread apart, causing distraction with subsequent delayed union. Distraction may also occur or a twisting force may give rise to absorption in the area around the screws, if the fixation material is not so introduced as to offset the stress in all directions.

One or more drill holes are made from one cortex to the opposite cortex. Screws of a non-electrolytic metal, of the self-tapping type, and of correct length are selected. The screws are seated and they should fit tightly. If the fracture is comminuted, each fragment with its attached soft tissues left intact is fixed to the main fragment by means of a screw. These fragments act as grafts. It is a mistake in treating comminuted fractures to remove a fragment, thereby creating a loss of bone substance that can make for hemidistraction. When a screw lies near the surface, as on the crest of the tibia, it should be countersunk. After the fixation has been completed the fragments should be rigid in position.

Sulfa drug crystals are dusted into the wound in cases of extensive trauma or when the fracture is compound. The wound is closed in the routine manner. The removal of the screw after union has taken place is optional except in the case of tibial fractures in which, if feasible, the fixation material should be removed.

The retentive dressing varies with the site of the fracture. In fractures of the humerus only a light retentive dressing is applied. In fractures of the femur or tibia and fibula there is need of supplementary fixation, because the threads of the screws in themselves do not provide for stability on movement of the limb in the early stage of callus formation. A thinly padded, circular cast is usually applied. If there is evidence of infiltration of the soft tissues, one or two molded plaster shells may be used first and later replaced by usable plaster dressings.

Weight-bearing with protection is started as soon as possible after the reduction of the fracture. The exact time of weight-bearing depends to a great extent upon the condition of the musculature and upon the patient's dexterity in using walking aids.

The plaster cast is changed in two or three weeks and again as required until union is complete. Care must be taken to detect and correct any angulation which would tend to delay union. Roentgenograms are taken at intervals to determine the stage of union.

SCREW FIXATION OF FRACTURES OF THE TIBIA AND FIBULA

Oblique, spiral and comminuted fractures of the tibia or of both bones of the lower leg are among the most common fractures of the long bones. The treatment of fractures of both bones is actually a problem of reducing and maintaining the tibial fragments, following which the fibu-

lar fragments fall into place. In adults the treatment of fractures of the lower leg is a problem, not only because of the difficulty of maintaining reduction but also because there is a sluggishness in the healing process, particularly in fractures of the mid and lower thirds of the tibia. As a rule, the length of time required for union to take place is entirely out of proportion to the severity of the injury.

It is customary to overcome the tendency to displacement by the use of either balanced suspension traction or double pin traction. Operators have been none too well satisfied with the results of these methods and have concluded from investigations that the establishment of union is unduly prolonged under traction methods, even when there is no apparent distraction force present. When there is obvious distraction, union is markedly delayed; for in the tibia, where the blood supply is poor, distraction has a disastrous effect. From six to twelve months may be required for union to take place. The distraction may be due to overpull in an attempt to secure precise apposition of the fragments. In fractures of both bones of the leg, when the fibula unites faster than the tibia, distraction of the tibial fragments may result from the by-passing effect of the thrust at the point of the fracture.

There is no question that the long period of hospitalization required by balanced traction is an objectionable feature. There is also the danger of angulation of the fragments under treatment by traction as well as the danger of forward or backward bowing when double pin traction is used.

Operative reduction and direct fixation is the method of choice in treating spiral, oblique and comminuted fractures of the lower leg. Several operators (Ronald, Headings, Burns and Young, Watson-Jones and Coltart, Hudack, Mansfield and Murray), after making comparative studies of fractures treated by internal fixation and by traction, reached the conclusion that the former is the preferable treatment. It offers a simpler course and is productive of good results in a shorter period of time. The findings in the short series of sixteen fractures of the tibia and fibula being reported bear out this observation.

Analysis of Cases. Details as to the ages of the patients and the type and site of the sixteen fractures are given in Table 1. Five of the fractures were compound. Fourteen were fresh fractures, in twelve of which screw fixation was carried out as the primary treatment. In the other two fresh fractures manipulative treatment had been unsuccessful. The patients in the two cases of long standing had been treated by manipulation and traction methods, and distraction had been a factor that delayed union in one patient. (Figs. 3 and 4.)

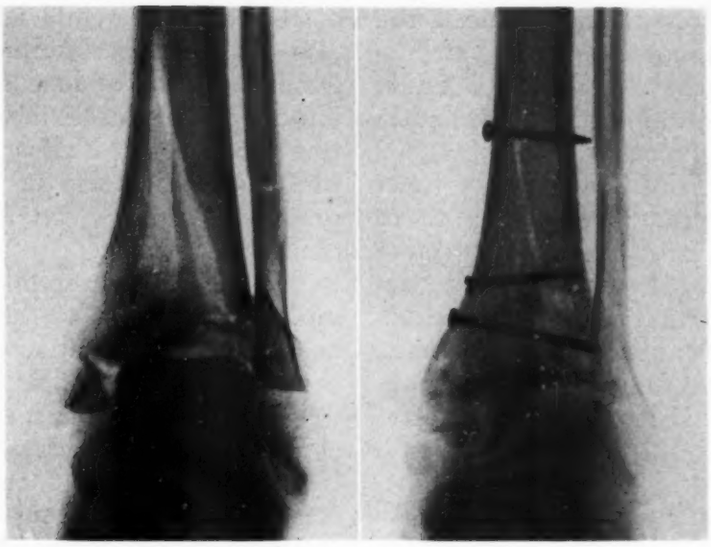
The average stay in the hospital in thirteen of the fourteen cases of fresh fractures was nine days. In the other fresh fracture the prolonged hospitalization was due to an associated fracture of the pelvis.

Union was considered to be complete when the patient was able to bear weight without the aid of retentive or supportive apparatus, was free from pain and when roentgenograms showed a continuity of callus. In estimating the average time of union, three cases were deleted from the series because one patient died from a coronary thrombosis in the third postoperative week, and in the other two cases operative reduction had been carried out late. The average time of union in the remaining thirteen cases was between sixteen and seventeen weeks. In Cases 4, 6 and 16 the delay in union must be referred to poor technic which resulted in distraction in the first case (Fig. 2), angulation with absorption of the area around the screws in the second case and separation of the fragments in the third case, due to the failure to engage both cortices in the introduction of the screws. Healing was slow in Cases 13 and 14 because of the severity of the injuries. In Case 9 there had been considerable soft tissue damage at the time of the fracture which resulted in a circulatory disturbance that delayed union. Because of the variation in ages and

TABLE I

DETAILS ON SIXTEEN FRACTURES OF THE TIBIA AND FIBULA TREATED BY SCREW FIXATION

No. of Cases	Age	Type and Site of Fracture													Associated Injuries	Treatment before Operation	Interval between Injury and Operation	Period of Hospitalization	Deaths	Complications	Time of Solid Union
		Tibia									Fibula			Compound							
		Spiral			Oblique			Comminuted													
		U	M	L	U	M	L	U	M	L	U	M	L								
1.	59	..	..	√	..	..	..	..	..	..	√	..	√	..	.....	.....	1 wk.	10 days	Coronary thrombosis 2 wk. after operation		
2.	60	..	..	..	..	..	..	..	..	√	..	..	√	√	Multiple fractures of pelvis	.....	1 wk.	4 wk.	.....	.....	12 wk.
3.	47	..	..	..	..	..	√	..	..	..	..	..	√		.....	Manipulation; traction (distraction)	4 mo.	4 wk.	.....	.....	10 mo.
4.	77	..	..	..	..	..	..	..	√	..	..	..	..	√	.....	.....	6 days	5 days	.....	Distraction	8 mo.
5.	19	√	..	..	..	..	..	..	..	..	..	..	..	..	Fracture into knee joint	Manipulation; traction	30 days	2 mo.	.....	.....	13 wk.
6.	16	..	..	√	..	..	..	..	..	√	..	..	..	√	.....	.....	Same day	3 wk.	.....	Angulation	4 mo.
7.	36	..	..	√	..	..	..	..	..	√	..	..	..	..	.....	.....	2 days	1 wk.	.....	.....	9 wk.
8.	50	..	..	√	..	..	..	..	..	√	√	..	..	..	.....	.....	3 days	3 days	.....	.....	10 wk.
9.	42	..	..	..	..	..	..	..	√	..	..	√	..	√	.....	.....	Same day	4 days	.....	Circulatory disturbance	4½ mo.
10.	47	..	..	√	..	..	..	..	..	..	..	..	..	..	.....	.....	1 wk.	4 days	.....	.....	3 mo.
11.	10	..	..	..	..	..	..	..	√	..	..	..	√	..	Head and rib injuries	Manipulation	5 days	5 days	.....	.....	8 wk.
12.	38	..	..	√	..	..	..	..	..	√	√	..	..	..	.....	.....	5 days	1 wk.	.....	.....	8 wk.
13.	36	..	..	..	..	..	..	..	..	√	..	..	√	..	.....	.....	3 days	2 wk.	.....	Severe injury	4½ mo.
14.	40	..	..	√	..	..	..	..	..	√	..	..	..	..	Ankle joint	.....	2 days	2 wk.	.....	Severe injury	5 mo.
15.	42	..	..	√	..	..	..	..	..	..	..	..	..	..	.....	Manipulation	1 wk.	10 days	.....	.....	10 wk.
16.	53	..	..	..	..	..	√	..	..	..	..	..	..	√	.....	.....	2 days	10 days	.....	Separation of fragments	20 wk.



A B

Fig. 3. Case 2 (Table 1). A, compound fractures of the lower tibia and fibula. Screw fixation was performed as the primary treatment. B, roentgenogram taken two months after operation.

A B

Fig. 4. Case 15 (Table 1). A, spiral fractures of the lower tibia and upper fibula with the usual displacement and posterior sagging of the tibia. Manipulative reduction proved unsuccessful. Screw fixation was performed ten days after the injury. B, roentgenogram taken six months after operation. Union took place rapidly and was solid in ten weeks.

complicating factors that influenced the recovery, it was impossible to make deductions as to whether the rate of union differed in fractures at specific sites and in different types of fractures.

All patients obtained satisfactory functional results. Details are lacking as to when patients returned to their respective occupations. One salesman (Case 9) returned to work in four weeks after reduction while the leg was still in a plaster cast. The worker in the foundry (Case 14) resumed heavy work in five months after reduction.

SCREW FIXATION OF FRACTURES OF THE FEMUR

In adults fractures of the femur are serious injuries, often entailing prolonged disability and a great time loss from work. In oblique, spiral and comminuted fractures manipulation and plaster fixation prove to be ineffective in the face of insufficient serrations of the fragment ends and strong displacing muscle forces. Particularly is this true in fractures of the upper femur in which the distal fragment is pulled medially by the forceful adductor muscle group. Under management by traction methods the average stay in the hospital is eleven weeks, and this is followed by several months of incapacity during which the limb is immobilized and protected while function is cautiously resumed (VanGorder, Funsten and Lee). It is unusual for a man to return to work in less than six months, and the convalescence often extends from ten to twelve months when a fracture is treated by traction.

In children fresh fractures above the mid-shaft may invariably be treated satisfactorily by overhead traction, but there are cases in which the corrected position cannot be maintained by this method. Overhead traction is inadequate when the fracture is low down in the shaft. Therefore, when the fracture is seated below the mid-shaft or when in fractures at any site it is evident that reduction and retention will be difficult, screw fixation is the treatment of choice. In the child internal fixation is also indicated in fractures of the upper femur that are of long standing or malunited. In these cases in which the re-fracture necessary to effect reduction may cause severe shock, a short operative procedure such as screw fixation is particularly advisable.

The period of hospitalization following screw fixation is short, the patient usually being discharged in about two weeks. With the limb protected by a plaster cast, light weight-bearing may begin as soon as the patient is able to handle crutches well. Union in the average uncomplicated case is complete in less than four months following screw transfixion. Functionally, the results are excellent, since the danger of shortening, angulation, or impairment of joint motion is negligible.

Analysis of Cases. As shown in Table II, screw transfixion was carried out in eleven fractures of the femur. Details as to the ages of the patients and the type and site of the fractures are given in the Table. In six of the eleven cases, screw fixation was carried out as the initial treatment. In five cases the fractures had been first treated by traction methods by other physicians and had proved to be irreducible. (Figs. 5 to 7.)

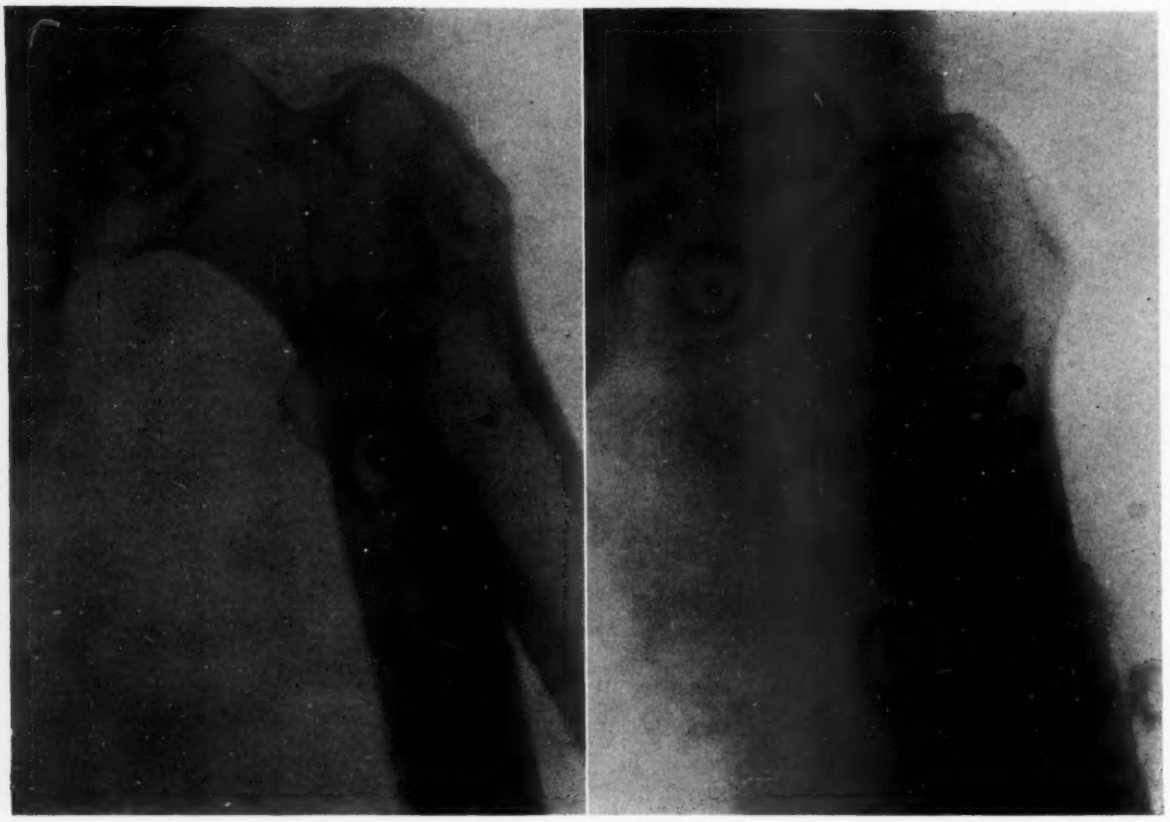
The complications and associated injuries that influenced the periods of both hospitalization and recovery are listed in Table II. There was one postoperative death from severe shock in the case of a boy, aged fifteen, who had a fracture of the upper femur which was operated upon after unsuccessful treatment by traction measures for five weeks. In the five cases in which there was no associated injury or complication, the patients were discharged from the hospital in thirteen days.

The criteria used in estimating complete union were full weight-bearing capacity without pain and without external support, and evidence of continuous callus in roentgenographic studies. In nine cases (case of postoperative death and case of amputated limb excluded from the series)

TABLE II

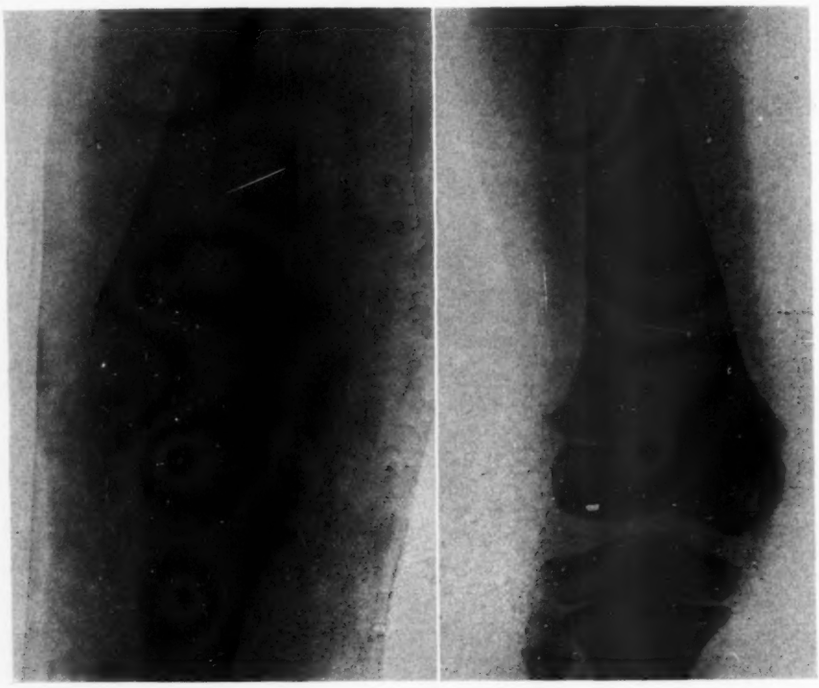
DETAILS ON ELEVEN FRACTURES OF THE FEMUR TREATED BY SCREW FIXATION

No. of Cases	Age	Type and Site of Fracture												Associated Injuries	Treatment before Operation	Interval between Injury and Operation	Period of Hospitalization	Deaths	Complications	Time of Solid Union
		Spiral			Oblique			Comminuted			Transverse									
		U	M	L	U	M	L	U	M	L	U	M	L							
1.	72	..	..	√	..	..	..	..	..	√	..	..	..	.....	.....	6 days	12 days	.....	.....	13 wk.
2.	15	..	..	..	√	..	..	..	..	..	..	..	..	.....	Traction	5 wk.	.....	Died of shock		
3.	3	..	..	..	..	..	..	..	..	..	√	..	..	.....	Traction	18 days	15 days	.....	.....	6 wk.
4.	28	..	..	..	..	..	..	..	√	..	..	..	..	Damage to thigh muscles	.....	5 days	21 days	.....	One fragment irreducible	26 wk.
5.	4	..	..	..	..	..	..	..	..	√	..	..	..	Spine injury with foot paralysis	Traction	18 days	14 days	.....	Foot drop	8 wk.
6.	10	√	..	..	..	..	..	√	..	..	..	..	..	Ankle laceration; concussion	Traction	14 days	17 days	.....	.....	13 wk.
7.	6	..	..	..	..	√	..	..	..	..	..	..	..	.....	.....	7 days	14 days	.....	.....	10 wk.
8.	27	..	..	√	..	..	..	..	..	..	..	..	..	.....	Traction	3 days	10 days	.....	.....	13 wk.
9.	37	..	..	..	√	..	..	√	..	..	..	..	..	.....	.....	4 days	14 days	.....	.....	15 wk.
10.	52	..	..	√	..	..	..	..	..	√	..	..	..	.....	.....	6 days	13 wk.	.....	Pulmonary infarction	30 wk.
11.	15	..	..	..	√	..	..	..	..	..	..	..	..	Fracture other femur	.....	6 wk.	13 wk.	.....	Amputated leg on same side as fracture treated by screw fixation	26 wk.



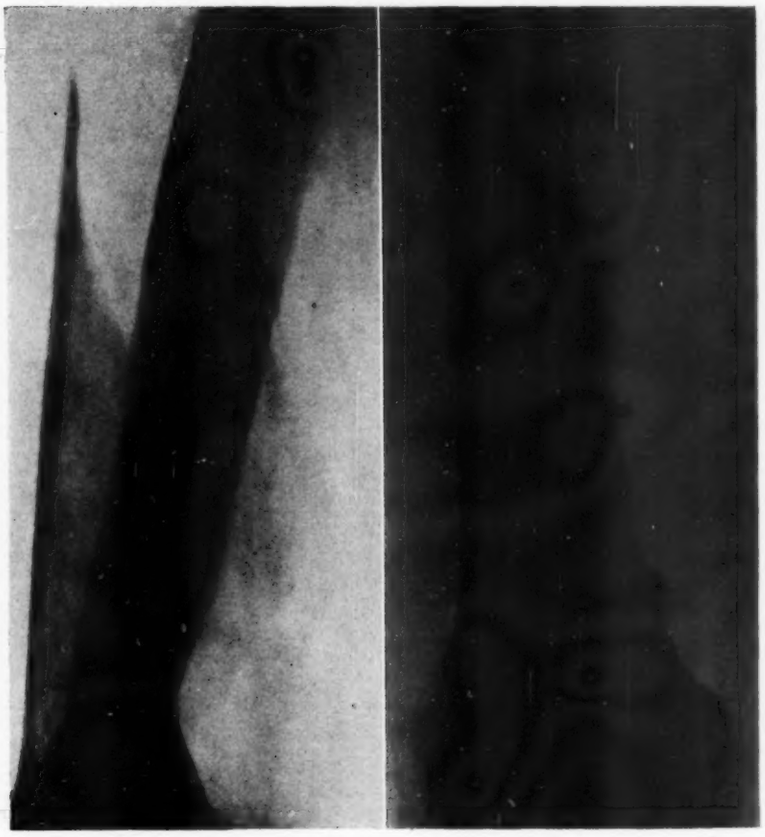
A B

FIG. 5. Case 9 (Table II). A, oblique, comminuted fracture of the upper femur in a patient aged thirty-seven years. Screw fixation was performed as the primary treatment. B, roentgenogram taken approximately two months after operation.



A B

FIG. 6. Case 5 (Table II). A, comminuted fracture of the lower femur in a child aged four years. Primary treatment by manipulative and traction methods failed. Screw fixation was performed eighteen days after the injury. B, roentgenogram taken nine months after operation.



A B

FIG. 7. Case 1 (Table II). A, comminuted, spiral fracture of the lower femur involving the knee joint in a patient aged seventy-two years. Screw fixation was performed as the primary treatment. B, roentgenogram taken three months after operation.

union was established in fifteen weeks. As was to be expected, union took place earlier in the fractures in children than in those in adults. It was not possible to make deductions as to the rapidity or delay in healing in various types of fractures or in fractures at different sites, owing to the variation in ages and complicating factors.

The functional results were satisfactory; the patients walked without a limp and with free joint motion. Details on the time resuming work were obtained in only two of the five adult cases. One farmer (Case 9) returned to work in four months after the operation. It was a year before a driver of a tractor (Case 4) resumed work, but in this case an irreducible fragment had persisted as a sensitive spur and had to be removed.

SCREW FIXATION OF FRACTURES OF THE HUMERUS

In certain types of fractures in the upper end of the humerus it is difficult to effect reduction and ensure retention of the fragments. In this group is the spiral or comminuted fracture situated below the insertion of the pectoralis major muscle, in which the upper fragment is pulled inward toward the axilla and rotated forward by the pectoralis muscle. (Fig. 8.) Indications for operative reduction and internal fixation should be recognized in this type of fracture. Following screw fixation, no complicated dressing or apparatus is necessary.

Another type of fracture of the upper end of the humerus, which usually can be reduced only by surgical intervention, is a break involving the upper epiphyseal plate

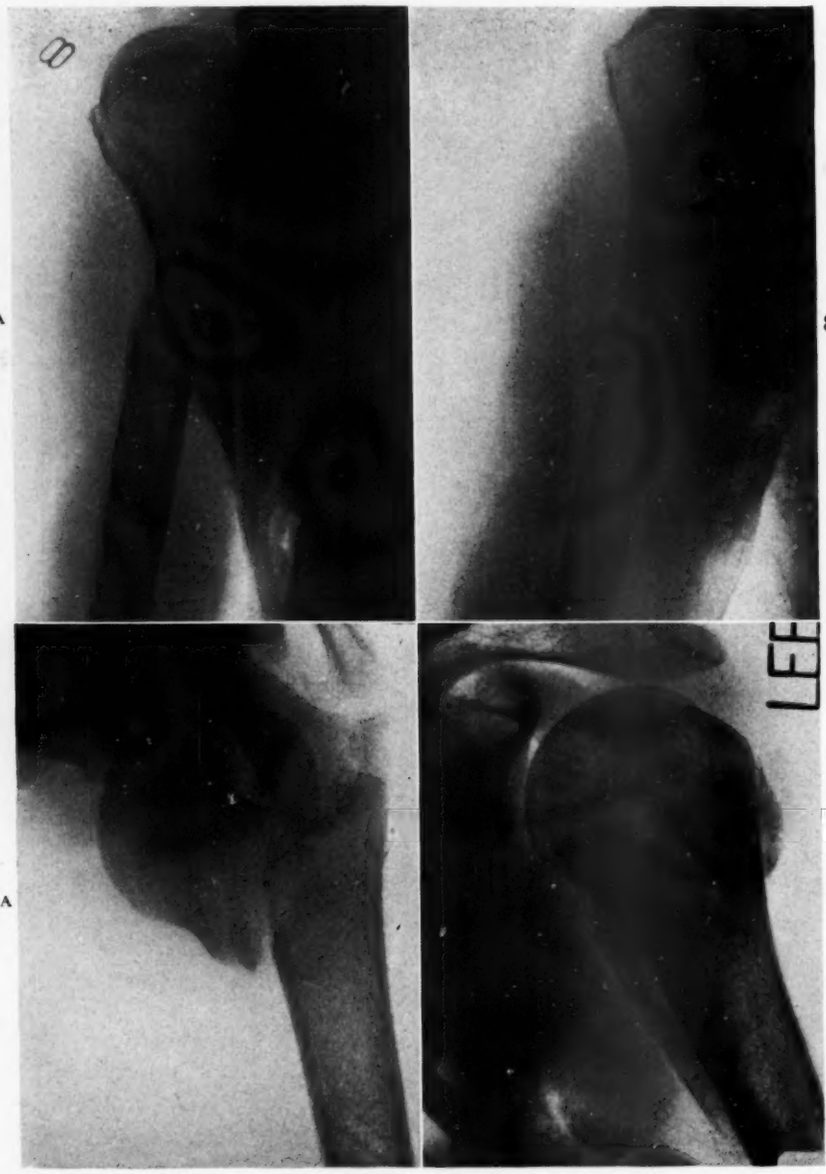
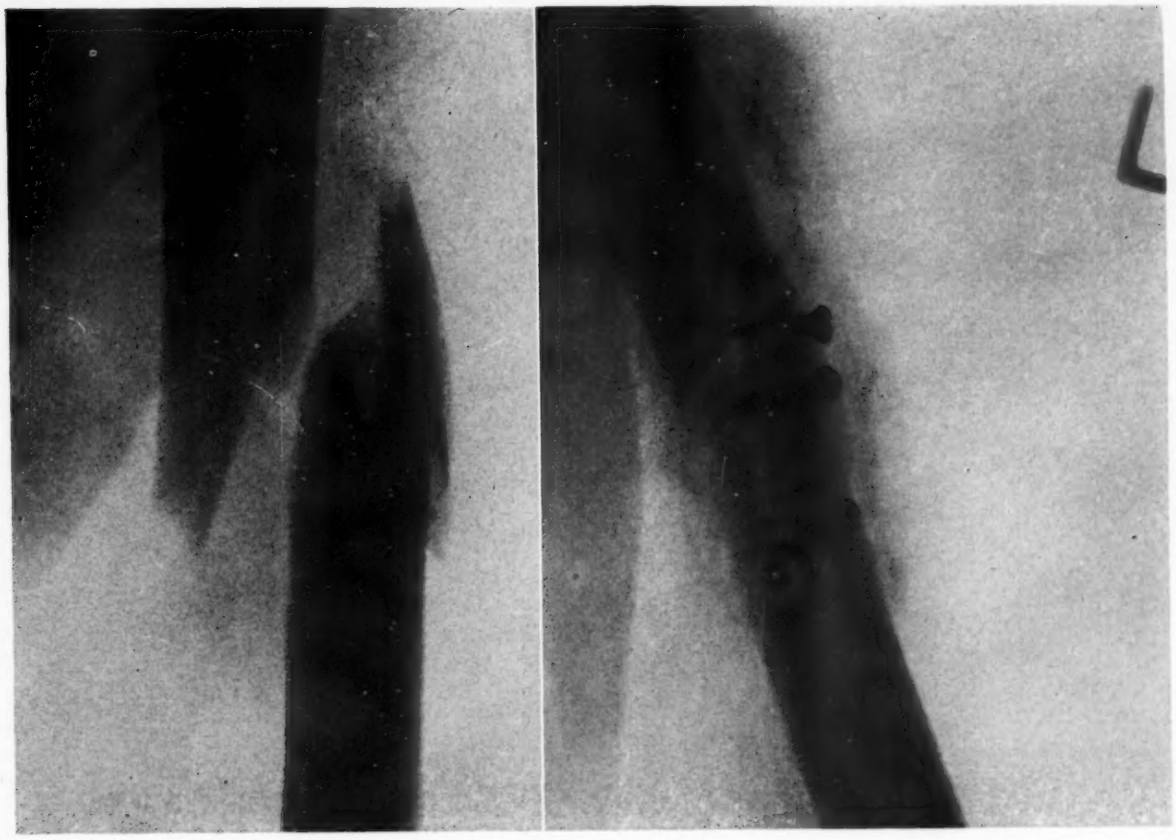


FIG. 8. Case 4 (Table III). Spiral fracture of the upper end of the humerus with adduction displacement of the proximal fragment. Primary treatment by manipulation failed. Screw fixation was performed one week after the injury. B, roentgenogram taken four days after operation.

FIG. 9. Case 11 (Table III). A, fracture of the upper epiphyseal plate of the humerus with a spicule of the shaft attached to the proximal fragment. Primary treatment by manipulations failed. Screw fixation was performed two weeks after the injury. B, roentgenogram showing the screw in place. Note the overgrowth of callus along the humeral shaft. (This illustration appeared in *J. Bone & Joint Surg.*, 26: 401, 1944.)

in which a spicule of the shaft is split off with the humeral head. (Fig. 9.) This fracture is uncommon and is seen in adolescents. Conservative methods are not only ineffective but manipulative attempts at reduction may actually be harmful in that they result in the formation of callus along the humeral shaft. This callus tends to persist even when operative reduction is finally obtained.

There are two reasons why conservative methods are inadequate in the treatment of these fractures: First, the line of fracture is slanting and irregular and the broad



A B

Fig. 10. Case 7 (Table III). A, comminuted fracture of the mid-shaft of the humerus, irreducible by manipulative and plaster fixation method. Screw fixation was performed five and a half weeks after the injury. B, roentgenogram taken one month after operation.

upper and outer edge of the distal fragment is thrust through a slit in the capsule of the joint and gripped tightly by the capsule; secondly, the long head of the biceps tendon lies between the fragments. When traction is applied in an attempt to reduce the fracture, both the capsule and the biceps tendon become taut, thus preventing reduction of the arm. Reduction cannot be accomplished by rotating or angulating the fragments because the tight capsule carries the head fragment along with the shaft.

When an operative reduction is carried out early before the capsular sleeve extension is infiltrated with exudate to the point of contracture, it is usually possible to suture the fragments. When, however, operative indications are not recognized for several days, there is a tendency for displacement to recur if screw fixation of the fragments is not carried out.

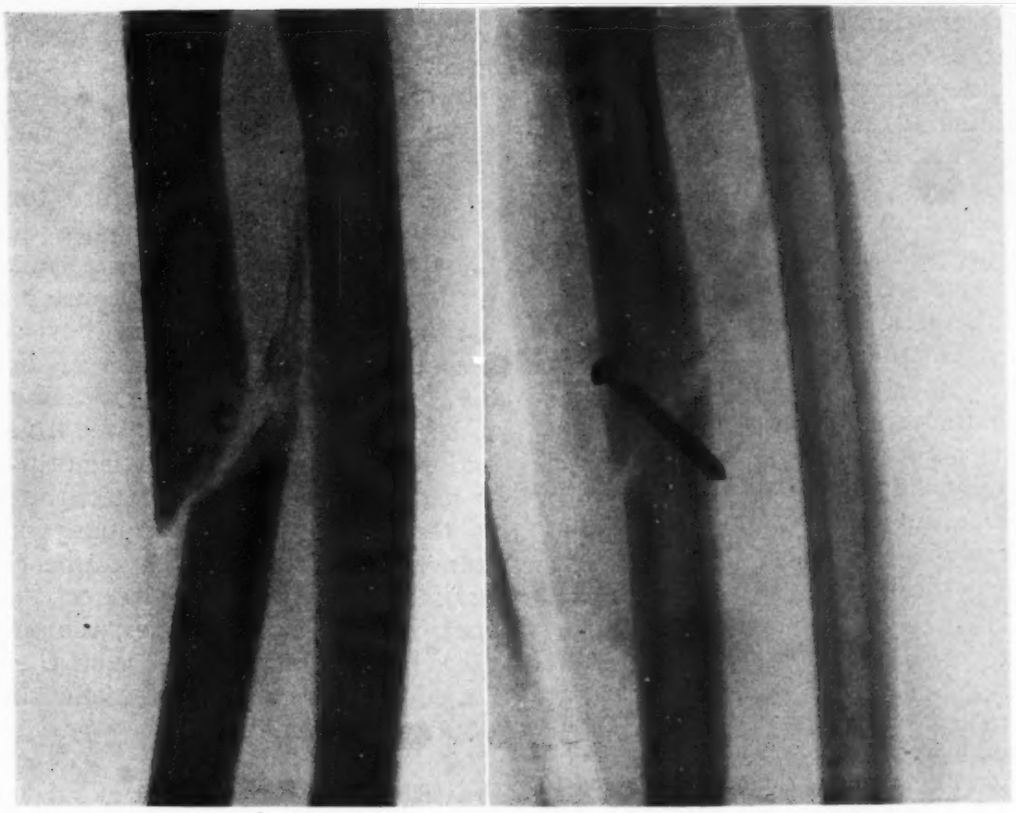
Fractures of the mid-shaft of the humerus seldom require internal fixation. Operative treatment is indicated in the compound fracture and in an occasional case of a closed fracture in which reduction or the maintenance of the fragments in the correct position is impossible. (Fig. 10.) Screw fixation can also be used to advantage in fractures of the mid-shaft when the patient is obese and would find the retentive dressing supplementing manipulative handling uncomfortable. Screw fixation is an excellent form of treatment when it is imperative to avoid prolonged hospitalization and convalescence.

In fractures of the lower end of the humerus with a short distal fragment, it is difficult to obtain and hold reduction by manipulative or traction methods. Accurate reduction, on the other hand, is important because any overgrowth of

TABLE III

DETAILS ON THIRTEEN FRACTURES OF THE HUMERUS TREATED BY SCREW FIXATION

No. of Cases	Age	Type and Site of Fracture													Associated Injuries	Treatment before Operation	Interval between Injury and Operation	Period of Hospitalization	Complications	Time of Solid Union
		Oblique Spiral						Comminuted			Oblique with Spicule	Compound								
		U	M	L	U	M	L	U	M	L	Upper	U	M	L						
1.	63	..	..	..	..	√	..	..	..	..	.....	..	..	..	.....	Traction	9 days	14 days	Weak muscles; bone soft, cortex thin	10 wk.
2.	60	..	..	..	√	..	..	..	..	..	.....	..	..	..	.....	.....	1 day	5 days	.....	9 wk.
3.	55	√	..	..	..	..	..	..	..	..	.....	√	..	..	.....	.....	Same day	4 days	.....	9 wk.
4.	57	..	..	..	√	..	..	..	..	..	.....	..	..	..	.....	Manipulation	7 days	12 days	.....	10 wk.
5.	63	..	..	..	..	..	..	√	..	..	.....	..	..	..	Periosteal tearing	.....	Same day	7 days	.....	10 wk.
6.	44	..	..	..	..	√	..	..	..	..	.....	..	√	..	Compound 3 places	.....	At once	10 days	Severe damage to soft tissues	13 wk.
7.	30	..	..	..	..	..	..	..	√	..	.....	..	..	..	Compound fracture patella	Manipulation	5½ wk.	14 days	.....	8 wk.
8.	55	..	..	√	..	..	..	..	..	..	.....	..	..	..	.....	.....	5 days	3 days	.....	10 wk.
9.	49	..	..	..	..	√	..	..	..	..	.....	..	..	..	.....	.....	3 days	2½ wk.	.....	10 wk.
10.	13	..	..	..	..	..	..	..	..	..	√	..	..	..	.....	Two manipulations	2 days	4 days	.....	8 wk.
11.	15	..	..	..	..	..	..	..	..	..	√	..	..	..	.....	Two manipulations	1 wk.	4 days	.....	8 wk.
12.	15	..	..	..	..	..	..	..	..	..	√	..	..	..	.....	Repeated manipulations	2 wk.	4 days	.....	8 wk.
13.	15	..	..	..	..	..	..	..	..	..	√	..	..	..	.....	Repeated manipulations	2 wk.	4 days	.....	8 wk.



A B

FIG. 11. A, oblique fracture of the ulna accompanied by a slight dislocation of the head of the radius that is not demonstrated in the roentgenogram. Following treatment by splinting, further dislocation of the radial head occurred. Screw fixation of the ulnar fragments and removal of the head of the radius were carried out two months after the injury. B, roentgenogram taken one week after operation.

callus may lead to involvement of the radial nerve. Screw fixation is indicated in these fractures.

Analysis of Cases. The author's series of fractures of the humerus comprised thirteen cases, two of which were compound fractures. Table III gives the details as to the ages of the patients and the type and site of the fractures. Screw fixation was carried out as the primary treatment in six cases. In six of the seven patients who had been under the care of other physicians manipulative treatment had failed, and in the seventh case traction had been unsuccessful.

The period of hospitalization was short, the average stay in the hospital in the thirteen cases being eight days. Healing was considered complete when the patient had full use of the arm and there was roentgenographic evidence of solid union. In the thirteen cases the average period required for union was nine and one-quarter weeks. In Case 6 the delay in union was due to the severity of the injury, the fracture being compound in three places and associated with extensive damage to soft tissues. The functional results in all cases were excellent and most patients could use the arm before union was complete.

SCREW FIXATION OF FRACTURES OF THE FOREARM BONES

Short oblique fractures of the radius may present difficulties in reduction and retention. Short oblique fractures of both bones of the forearm situated at either the same level or at different levels, as in the upper third of one bone and in the mid-third of the other bone, may be difficult to control.

There is also the danger that if the ulna unites ahead of the radius, a distraction force and off-line stress may result that delays union in the radius. Another forearm fracture that is difficult to control is the short oblique or spiral fracture of the ulna accompanied by dislocation of the head of the radius (Monteggia's fracture).

Operative reduction with internal fixation of the ulnar fragments is the accepted primary treatment of the Monteggia's fracture. Open reduction is indicated in forearm fractures of other types that are difficult to control by conservative measures; and if the fragments cannot be locked in position, internal fixation is required. A single screw is an efficient form of fixation, provided the fragments are sufficiently oblique.

CASE REPORT

The patient, a man, aged twenty-five years, sustained a fracture of the ulna accompanied by a slight dislocation of the head of the radius. The fracture was treated by manipulation by another physician and a splint applied. Two months later the case came to the attention of the author.

A roentgenogram taken at the time of the examination showed a Monteggia's fracture with non-union of the ulnar fragments. A long spur projected from the ulna, producing a synosteosis between the forearm bones. (Fig. 11A.)

On May 17, 1943, an operative reduction was performed. The head of the radius was removed. The ulnar fragments were freshened and fixed in position by means of a screw. (Fig. 11B.)

Seven weeks after the operation the fracture was clinically solid, but the recovery of rotary motion was delayed because of the absent head of the radius. In May, 1946, three years after the reduction, the elbow motion was good but the rotary motion was still limited.

SUMMARY

Experience with internal screw fixation in a relatively small series of forty-two cases leads to the conclusion that the method has an established place as the treatment of selected fractures of long bones. The results were of good quality; there was no shortening, no deformity and no disturbance of joint function.

Operative screw fixation has certain advantages over the traction methods in use. It requires only a short period of hospitalization. The patient is free from pain and discomfort. Although it is not possible to make an accurate estimate of the period of recovery owing to the many circumstances and factors that have a bearing on healing, the conclusion seems justified that, in this series of cases, the time required for union was shorter than the period generally estimated for healing under traction methods.

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ETIOLOGY OF GOITER IN MAN*

NEW CONCEPTS

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THE establishment of the existence and powerful operation of whole systems of goitrogens would alone seem to necessitate a drastic revision of the familiar concepts concerning the etiology of goiter in man. But also the newer biochemical and pharmacological knowledge comprehends such novel factors as biologic or metabolic competition between structurally related compounds, including structural analogues antagonistic to thyroxine. In accordance with clear scientific logic, the possibly basic causative action of a variety of chemical influences hitherto unknown or neglected must be taken into consideration in work upon the problem of goiter etiology. The purpose of this paper is to indicate the *possibilities* that must be accounted for by adequate researches rather than to speculate upon *presumable probabilities*. Justification for such a discussion of possibilities is found in the fact that the problem of goiter causation has not previously been considered in the light of the newer and apparently revolutionary findings in regard to goitrogens and metabolic competition between similar and, in certain instances, dissimilar molecules, especially thyroxine and related compounds.

GOITROGENS

The existence of goitrogens was suspected for centuries. Innumerable early writers suggested that some chemical cause of goiter, especially endemic goiter, would be discovered in drinking water or certain articles of diet. In many goiter regions the comparatively high concentrations of calcium in the water have repeatedly attracted attention to this element as a possible etiologic factor. Excess of pork or fat was long suspected, as by St. Lager (1867). Indeed it was shown by Marine and Lenhart (1910) that thyroid hyperplasia may be induced in dogs and brook trout by the feeding of pig's liver. McCarrison (1920) reported that fat-feeding had a similar effect in pigeons; Mellanby and Mellanby (1921) also brought about thyroid hyperplasia in dogs by the same means.

Bircher (1911) stated that he was able to induce the appearance of large goiters in white rats by giving them water from a region in which goiter was endemic; further, these animals showed great enlargement of the heart with hypertrophy of the left ventricle. Hellwig (1944) expressed the belief that a high calcium intake may indeed be the cause not only of goiter but of "goiter heart"; and his experimental findings on white rats fed a high-calcium diet were similar to those reported by Bircher to follow administration of "goiter-causing" water. No confirmation of such work has been forthcoming.

Other lines of investigation have been vastly more profitable and the results are now indisputable. Numerous goitrogens have been shown to be present in common foods of animals and man, and systems of compounds having goitrogenic activity have been found among familiar or newly synthesized drugs.

In 1928 Chesney, Clawson and Webster noted that a colony of rabbits were rapidly becoming goiterous; it was soon established that the etiologic factor was present in cabbage. The thyroid glands were extremely hyperplastic but the animals had low metabolic rates. Iodine administration was found to prevent the development of "cabbage goiter," but when iodine was

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given after the goiter had developed, a severe thyrotoxicosis resulted promptly. These findings were confirmed by Marine, Baumann, Spence and Cipra (1929, 1932) who determined also that the leaves of many brassica plants contained some goitrogen. Suk (1931) reported the endemic occurrence of large goiters in a community in Carpathian Ruthenia where the principal dietary item was cabbage.

Because of the reported isolation of certain nitrile compounds from the leaves of several brassicae (cabbage, Brussels sprouts, cauliflower), the action of a number of cyanide compounds on the thyroid glands of laboratory animals was investigated by Marine and his associates (1932, 1934), Spence (1932, 1934) and others. It was observed that methyl cyanide and certain other nitriles produced marked thyroid hyperplasia with low metabolic rates and exophthalmos. Sharpless et al. (1939) recorded the production of goiter in rats by feeding raw or treated soy bean flour; such goitrogenic action was prevented by administration of iodine. In 1941 Kennedy and Purves found that rape seed and the seed of other brassicae can be used to produce goiters in rats.

Mackenzie, Mackenzie and McCollum, also in 1941, found that when sulfaguanidine was fed to rats for short periods of time, there resulted a marked enlargement and hyperplasia of the thyroid gland, an effect that was not inhibited by iodine. Richter and Clisby (1941, 1942) noted that phenylthiourea was goitrogenic, and, at about the same time, Kennedy, Purves and Griesbach described in greater detail the goitrogenic action of rape seed, Kennedy later (1942) attributing this action to allyl thiourea, presumably a constituent of rape seed. The concepts that goiter resulting from the action of sulfonamides and thiourea is compensatory and that the primary effect of such substances is inhibition of synthesis of thyroid hormone were set forth by the researches of the Mackenzies (1943) and Astwood and his associates (1943). Astwood and others followed up the suggestion that compounds related to the sulfonamides and thiourea might be valuable therapeutic agents. The chemical nature of the compounds which inhibit the function of the thyroid gland was discussed by Astwood (1943) who at that time remarked that the compounds tested could be divided into three classes: thiourea derivatives, those containing an aminobenzene grouping and the thiocyanates. The thioureas as a group are the most active goitrogens, thiouracil showing the highest activity. The aminobenzene derivatives include the common sulfonamide drugs, of which sulfadiazine is the most active. Iodine administration prevents the goitrogenic action of the thiocyanates but not that of the other two classes.

The differentiation of the antithyroid action of thiouracil, thiourea and para-aminobenzoic acid from sulfonamides by iodine administration has very recently been described in detail by C. G. Mackenzie (1947). Mackenzie observed that small amounts of iodine inhibit the goitrogenic action of thiouracil by 50 to 100 per cent in rats, depending upon the level of the goitrogen employed. Higher levels of iodide do not increase this inhibition but suppress thyroid hyperplasia. When a low level of sulfaguanidine is administered, the goitrogenic effect is augmented by a high level of iodide; but this augmentation, or synergistic action, is not noted with either low levels of iodine or a high level of sulfaguanidine. Nevertheless, according to Mackenzie, iodide seems to increase the degree of thyroid hyperplasia under all the conditions studied. Further, para-aminobenzoic acid resembles thiouracil rather than sulfaguanidine insofar as both its goitrogenic and hyperplastic actions are inhibited by iodide. Mackenzie concluded that thiouracil, thiourea and para-aminobenzoic acid differ from the sulfonamides in the primary biochemical reactions responsible for their effects on the thyroid gland. Thus it is apparent that considerable modification of

earlier views concerning the relation of iodine intake to goitrogenic action is necessary. Depending upon the iodine level and upon the goitrogen, the goitrogenic action is either intensified or inhibited.

Other fundamental differences between goitrogens have been brought to light. Rawson, Tannheimer and Peacock (1944) employed a radioactive isotope to demonstrate that the thiocyanate goiter readily takes up iodine whereas the enlarged glands resulting from thiouracil administration do not. Species difference is still another highly important factor. When administered to chicks, aminobenzene derivatives show no goitrogenic effect (Mackenzie and Mackenzie, 1943), whereas in this species thiourea derivatives have high goitrogenic activity (Astwood et al., 1944; Mixner et al., 1944.)

It is well established that administration of desiccated thyroid or thyroxine inhibits the action of goitrogens in general (Webster and Chesney, 1928; Marine et al., 1932; Astwood, 1943; Salter et al., 1945). Griesbach, Kennedy and Purves (1941) showed that the pituitaries of animals having goiters produced by a brassica seed diet present histologic changes similar to those observed in the pituitaries of thyroidectomized animals. These investigators reported also that hypophysectomy prevents the development of goiters in animals which later receive goitrogens. Hence there arose the concept that the action of the various drugs which produce goiter is by means of an inhibition of, or interference with, the manufacture of the normal thyroid hormone (Rawson, Hertz and Means, 1943; Franklin and Chaikoff, 1943; Salter et al., 1945). The resulting increase in activity of the thyrotropic hormone of the pituitary induces hyperplasia of the thyroid cells, thyroid hormone production being at the same time decreased rather than increased. These investigations eventually led to the introduction of goitrogens into therapy of hyperthyroidism (Astwood, 1943; Himsworth, 1943; Williams and Bissell, 1943).

GOITER PRODUCTION IN MAN BY GOITROGENS

Hundreds of compounds have been tested and found goitrogenic and toxic in varying degrees when administered to animals. Many have been and are being used extensively (if not indiscriminately) in the treatment of thyrotoxicosis and even non-toxic adenomatous goiter. It is obvious, therefore, that many different agents not only may cause goiter in man but are actually being therapeutically employed as a result of their recognized goitrogenic action.

Goitrogenesis as an undesirable side-effect of a number of chemotherapeutic agents has also become a familiar manifestation. Goiters develop in a certain small percentage of hypertensive patients who are being treated with thiocyanate (Barker et al., 1941; Fahlung, 1942; Kobacker, 1942; Foulger and Rose, 1943; Rawson et al., 1943). The observations of Rawson and associates are typical. Goiters appeared in two patients who were receiving potassium thiocyanate for treatment of hypertension. Decreased thyroid function was indicated by clinical symptoms of hypothyroidism, low basal metabolic rates and plasma protein iodine levels usually observed in myxedema. An extreme hyperplasia of the thyroid gland was demonstrated in biopsy material removed from one patient. In one case there was exophthalmos with lid lag. In both cases the goiters and clinical signs of hypothyroidism disappeared when thyroid was administered in conjunction with thiocyanate.

A number of cases of goiter associated with sulfonamide therapy have been recorded, and related compounds have also been shown to be goitrogenic. In fact, goitrogenesis must now be recognized as an occupational hazard. Perrault and Bovet (1946) stated that in 1943 Jeantet of Lyons, France, observed unusual goiters in workmen employed in the extraction of aminothiazole which is used in the preparation of sulfathiazole. Perrault and Bovet were sufficiently impressed by the goitrogenic

activity and lack of toxicity of aminothiazole to try it in therapy of hyperthyroidism. The results in a large group of patients convinced these workers that the goitrogen is more effective and much less toxic than thiouracil.

Rawson, Hertz and Means (1943) have remarked that the action of goitrogens must be regarded as a problem of practical importance in view of "the advocated use of soy beans in the modern diet, the liberal prescribing of the sulfonamides in clinical medicine and widespread use of thiocyanate in treating hypertension."

Recent research suggests additional possibilities that have practical aspects. The very number of different substances already shown to be goitrogenic is remarkable and may not have received the attention it would seem to deserve. The extreme *lability* of the thyroid gland, long recognized as the most labile organ in the human body, is thus once again made manifest. Hundreds of substances have been proved goitrogenic when ingested in food or water. Many of these substances may be regarded as drugs from one point of view, but from another they are food factors, some indispensable, as in the instance of para-aminobenzoic acid. Many common foods contain goitrogenic substances; this fact is now beyond question.

Obviously, the ancient speculation that goitrogens would be found in foods has been transmuted into established fact. The fact is highly suggestive of possibilities, many of which would seem to be eminently worthy of practical consideration.

The number of *classes* of goitrogens is being steadily augmented. A striking addition to the list of known goitrogens is selenium. In 1946 Seifter and associates reported that the thyroid glands of white rats show increase in size, hyperplasia and loss of colloid after ten days on a diet containing 0.05 to 0.1 per cent of an organic selenium compound (*bis*-4-ace-taminophenyl-selenium). After 105 days on a diet containing the selenium compound at the lower level, the animals develop multiple adenomas of the thyroid gland.

As is well known, selenium occurs in toxic concentrations in the soil, water and vegetation of areas in at least thirteen States. More than 100,000 acres of seleniferous farmland have been taken out of cultivation in recent years. Nevertheless, many areas whose soil and water contain selenium (at a comparatively low and presumably non-toxic level) still are under cultivation. The significance of the low content of selenium in wheat grown in such seleniferous soil remains to be determined. The significance of goitrogenic agents in cabbage, cauliflower, other edible brassica plants, and in soy beans is apparently greater, and is generally believed, perhaps correctly, to have no relationship to endemic goiter. Possibilities can be eliminated only by research.

Investigations upon the effects of goitrogens ingested by man must henceforth be guided by the knowledge that species differences are at times marked. Another complicating factor is the possible synergism between two or more different goitrogens received at the same time and between iodine (at a certain level) and one or more goitrogens (Mackenzie, 1947). Moreover, now that the existence of many antithyroid substances has been established, the possibility is suggested that there may be groups of substances whose primary "target organ" is the pituitary, the thyroid gland being secondarily affected. Synergism between antipituitary and antithyroid substances—in varying combinations and concentrations—must be placed on the list of possibilities.

STRUCTURAL ANALOGUES ANTAGONISTIC TO THYROXINE

The discovery of biologic and metabolic competition between structurally related compounds has incited extensive biochemical researches whose findings already constitute a great new division of physiologic chemistry (Woolley, 1947). Within the past few years there have been found in nature or synthesized in the laboratory compounds which are structurally similar

to, but biologically antagonistic to metabolically important substances. These agents compete with hormones, vitamins or other metabolites and manifest their effects by the production of signs of deficiency of the metabolite to which the "bio-antagonist" is related in specific structural ways. For instance, in the testing of the presumed vitamin-like activity of substances structurally related to thiamine, it was found that instead of exhibiting thiamine-like effects certain structural analogues of thiamine induce signs of vitamin B_1 deficiency when the laboratory animal receives the "bio-antagonist" *and* thiamine (at a level otherwise high enough to prevent the appearance of signs of deficiency).

Because many "bio-antagonists" of metabolically important substances have been found to produce signs of deficiency of the analogous metabolite, Woolley proposed that a new series of pharmacologic agents might be produced by altering the structures of hormones or vitamins in definite ways. According to Woolley: "It was considered possible that such inhibitory structural analogues could be found against certain hormones which, as a result of overproduction, or diminished rate of destruction in the body, are the causative agents of disease. The excess hormone might be counterbalanced by administration of the structurally related antagonist." Woolley (1946) has been able to synthesize several new ethers of N-acetyldiiodotyrosine (structural analogue of thyroxine) that have been found to counteract the pharmacologic effects of thyroxine in experimental animals.

Investigators interested in the etiology of goiter must now consider the fact of the existence of structural analogues of thyroxine that counteract the effects of the hormone. Such analogues, "bio-antagonists," may exist in foods or may be produced normally or pathologically in the body.

Because thyroxine inhibits the action of many if not all goitrogens, *a priori* it would seem that the administration of goitrogen in conjunction with a bio-antagonist of thyroxine would be expected to enhance markedly the action of the goitrogen. (It is to be noted that certain of the bio-antagonists of thyroxine which were synthesized by Woolley have at once a strong antagonistic action (antithyroxine properites) and a weak thyrosine-like activity. The antithyroxine substance when administered alone shows weak thyroxine-like activity; administered in conjunction with thyroxine, the bio-antagonist signally diminished the effects of the metabolite. Goitrogens do not show thyroxine-like activity).

The existence of antihormones has long been postulated. Antithyroxine bio-antagonists are antihormones.

IODINE DEFICIENCY AND ENDEMIC GOITER

In 1916 Marine and Kimball (1917) instituted the prevention of endemic goiter in man by iodine prophylaxis on a large scale through the public schools of Akron, Ohio. By 1920 it had been demonstrated convincingly that the incidence of endemic goiter in adolescent girls could be reduced to a very low figure by keeping the thyroid saturated with iodine (Marine and Kimball, 1920). This brilliant and convincing demonstration of the definite relation between iodine deficiency and endemic goiter resulted, as is well known, in the almost universal adoption of iodine prophylaxis as a public health measure in goiter regions. The successes have been impressive. For instance, in 1924 a survey showed that the incidence of goiter in certain goiter sections of Michigan was 38.6 per cent. Iodine prophylaxis (by iodized salt) reduced the incidence to 8.2 per cent. In Cleveland the incidence of goiter among school children was found to be 31 per cent in 1924; iodine prophylaxis brought the incidence down to 18.5 per cent in 1937; the incidence among non-users of iodized salt was 30.7 per cent in 1937, among users of iodized salt, 7.7 per cent (Kimball, 1939). Because of neglect of this definitely indispensable public health measure, goiter has been on the increase in a number of goiter sections (Kimball, 1946).

Because of such great successes resulting from the large scale use of iodine prophylaxis in endemic goiter regions, many authors have promulgated the conclusion that iodine deficiency is the cause of all cases of endemic or simple goiter. Nevertheless, there are many facts which such a conclusion does not take into account. Iodine prophylaxis is effective in most but not all cases. Kimball (1939, 1946) stated that in certain sections of Michigan the incidence of goiter "among those using iodized salt regularly" was 2.88 per cent in 1936, twelve years after the institution of iodine prophylaxis in these sections. In Cleveland in 1937 the incidence of goiter among school children who were users of iodized salt (presumably since early infancy) was 7.7 per cent. It is a fact that iodine administered at a comparatively high level does not *completely* solve the problem of endemic goiter; children presumably "saturated" with iodine—certainly receiving iodine at a higher level than the average individual in many regions where goiter does not occur—nevertheless show a strikingly high incidence of goiter.

In a recent editorial on progress and future in the treatment of goiter, Cole (1944) stated: "It must be emphasized that restoration of the proper iodine intake alone cannot be expected to eliminate goiter because goiter of all types still exists along the seaboard where iodine intake (particularly in drinking water) is presumably adequate. Moreover, the added intake of iodine in iodized salt in these communities during the past few years has not resulted in any decrease in goiter. As a matter of fact, in some communities (for example, New Orleans) the incidence of goiter appears to be on the increase."

The incidence of goiter in parishes (the counties of other states) in the southern part of Louisiana, where iodine intake appears to be well above the average for the country at large, has impressed a number of authors. Mahorner (1944) has remarked in a recent paper: "Goiter is not uncommon among peoples inhabiting the banks of certain bayous. These rivers, often very deep, were originally estuaries of the Mississippi River. The surrounding lands are flat and low and frequently marshy and were formed by alluvial deposits of the Mississippi River. The diet of the people inhabiting this area consists presumably of much sea foods, and the iodine content of their vegetables is relatively high. The people themselves along these bayous recognize that nodular goiters are common. The explanation as to why the people in this low flat area should have more goiters than those in the rest of Louisiana is not available. All the soil of this area was brought down the river possibly from the upper Mississippi and the Ohio Rivers, which drain goiter belts. A positive goitrogenic factor thus may have been transported."

There are additional evidences that deficiency of iodine cannot account for all cases of simple goiter. Sporadic goiter occurs in regions where the iodine intake is high. "Epidemics" of goiter have been known to occur, as remarked many years ago by Hirsh (1883); these must have been evanescent exacerbations of general conditions among a population already affected by deficiency of iodine, but the iodine deficiency does not explain the sudden increase in incidence of endemic goiter. And now, of course, the production of goiters deliberately (in therapy of hyperthyroidism by administration of goitrogens) and inadvertently (by thiocyanates, sulfonamides and related compounds) has become a familiar demonstration of goitrogenesis without iodine deficiency.

ETIOLOGY OF THYROTOXICOSIS

In experimental animals severe thyrotoxicosis can be induced by (1) rendering the animal goiterous through the action of any one of variety of goitrogens and (2) administering iodine. Similar factors *may* be operative under natural conditions.

This possibility should interest the "unitarians" especially, i.e., those who have long maintained that simple goiter, exophthalmic goiter and toxic adenoma have the same underlying pathology. Until more has been determined concerning the action of goitrogens under natural conditions, discussion would be mere speculation. In the meantime, we may wonder about apparent relevancy of the fact that iodine administration occasionally causes exacerbation of Graves' disease and may even, as many have asserted, precipitate Graves' disease if relatively high dosages are given to patients with simple goiter. Harington (1933), for instance, has pointed out: "Graves' disease was not at that time recognized, but the description by Gairdner (1824) of the condition of goitrous patients after overvigorous treatment with iodine leaves no doubt that the syndrome of Graves' disease had been elicited or at least precipitated in them by the use of this drug."

ADENOMATOUS GOITER

Gorbman (1946) has shown that prolonged feeding of a goitrogen (thiourea) to mice causes the development of adenomatous goiters. Presumably these "non-toxic adenomatous" goiters could readily be transformed into "toxic adenomatous" goiters by administration of iodine although Gorbman has not mentioned the possibility. It is to be noted, however, that the goitrogen was fed at an extremely high level: thiourea constituted 2 per cent of the diet of the animals. (No approximation to such a level is ever attempted in therapy with antithyroid substances.)

METASTASES OF THYROID TISSUE

Gorbman (1946), after prolonged feeding of thiourea to mice, detected thyroid cells in veins of the thyroid gland, these cells evidently having become detached from the highly activated epithelium. This finding led him to examine the lungs wherein he was able to demonstrate histologically the presence of small islands of thyroid-like cells showing high mitotic activity. (Resumption of the normal diet was followed by involution of the activated epithelium.) The significance of these observations in relation to the possible natural action of goitrogens during a period of years cannot now be surmised. The possible co-action of a carcinogenic influence would be another consideration.

TOXIC AND NON-TOXIC ADENOMATOUS GOITER

The demonstration of the existence of structural analogues antagonistic to thyroxine, i.e., "bio-antagonists" of thyroxine, suggests the possibility that the presence of some such antihormone may explain certain differences between toxic and non-toxic goiter. If the bio-antagonist were present in non-toxic adenomatous goiter, presumably at least some of the effects of thyroid hormone would be counteracted. Disappearance of the biological competitor would, perhaps, explain the development of toxicity in a previously non-toxic case. A complicating factor would be fluctuating iodine intake.

"CARDIOTOXIC" GOITER

As early as 1887 Schranz remarked the occurrence of cardiac abnormalities in patients with goiter, especially adenomatous goiter, but without other symptoms or signs of a toxic condition. Among the many authors who have expressed a conviction that there is such an entity as "cardiotoxic" goiter are Hertzler (1936), Schmidt and Hertzler (1942), Rasmussen (1941) and Meyer and Ferguson (1942). Of course, as is well known, congestive heart failure may result from thyrotoxicosis alone (Rose, 1946). Plummer (1921) suggested that the thyroid gland in certain thyrotoxic patients secretes an abnormal thyroglobulin-like substance. Rose (1946) remarked: "This suggestion may have been too readily abandoned." Many authors have theorized that the heart may be directly affected by a specific "cardiotoxic" agent elaborated by

a goiter, whether or not the basal metabolic rate is elevated.

The discovery of thyroxine analogues antagonistic to thyroid hormone indicates still another possibility: Certain bio-antagonists may be *modulators* of the effects of thyroid hormone rather than *direct* antagonists. In fact, Woolley (1946) presented no evidence to show that *all* effects of thyroxine are directly counteracted by the antagonistic analogues tested. A modulator of thyroid hormone activity would, presumably, counteract or completely neutralize certain effects of the metabolite whereas other effects might even be augmented by a partial synergism. It is even conceivable that the physiologic effects of a metabolite might be given a new pitch or "keynote" so as to have the total influence of the metabolite exerted in a new, single direction toward some target organ such as the heart. It has not yet been demonstrated that any bio-antagonist is not a modulator rather than a direct antagonist. It is to be noted that however great the quantity of bio-antagonist present in the body, the metabolite is still present, capable of playing new rôles if not the old.

SUMMARY AND CONCLUSIONS

1. The demonstration of the existence of powerful goitrogens, many of which occur naturally, would seem to open the way to new concepts in the investigation of the causative factors in simple or endemic goiter.

2. Iodine deficiency is the outstandingly important causative factor in the development of simple goiter, but other factors are important also.

3. It is possible that goitrogens in drinking water, common foods or both are involved in the etiology of simple goiter.

4. New etiologic concepts concerning goiter are also suggested by the demonstration of the existence of structural analogues of thyroxine that counteract or modulate the effects of thyroid hormone.

5. Goitrogens and perhaps also bio-antagonists of thyroxine may be involved in the causation not only of simple goiter but also of exophthalmic goiter, toxic adenoma and non-toxic adenoma.

6. Under certain conditions prolonged ingestion of goitrogens may eventually cause the production of metastasizing tumors of the thyroid gland.

7. "Cardiotoxic" goiter may exist as an entity caused by the action of a modulator of thyroid hormone activity.

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CURRENT REAPPRAISAL OF TOTAL ABDOMINAL HYSTERECTOMY*

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SINCE the advent of meticulous preoperative preparation, which includes careful systemic inventory, the medical management of deviations from normal, the restoration of blood loss and the use of antibiotic chemotherapeutic agents the patient becomes a better candidate for gynecologic surgery. With the improvement of anesthesia and more cooperation between the surgeon and the anesthetist, with the use of longer incisions with resultant better surgical exposure, the emphasis of importance of the gentle handling of tissues and the administration of fluids, blood or plasma during surgery the patient is brought to her immediate recovery phase better than at any time heretofore. Moreover, advances in the knowledge of electrolyte balance, the giving of blood, plasma or fluids postoperatively, the intravenous administration of proteins and vitamins, early ambulation and the use of sulfa, penicillin or streptomycin all contribute for a speedier return to normalcy.

Today our fellow general surgeons can perform various extensive major surgical operations which often take five or six hours and may require four or five transfusions during surgery. Esophagectomy with supra-aortic intrathoracic esophagogastric anastamosis, total collectomy, pneumenectomy, total gastrectomy or abdominal perineal resection are done with comparatively low mortality rates.

It is a combination of all the aforementioned factors which have again swung the pendulum toward total abdominal hysterectomy. Total hysterectomy is more advantageous than subtotal hysterectomy because of the possible occurrence in the latter of carcinoma in the cervical stump; and the discharges due to endocervicitis, erosion, eversion or to circulatory changes subsequent to supracervical hysterectomy. It is also advantageous because of the absence of troublesome bleedings from the cervical stump which may be due to inflammatory disease due to cervical polyps, hypertrophy of the endocervix or the remnants of a small portion of endometrium. In a rare case strictures of the cervix may produce a hemato-or pyocervix.

Some observers are of the opinion that trichomonads or fungi may lodge in the crevices of the endocervix and be a site in the reinfection of these troublesome leukorrheas. With the emphasis on a "back to fundamentals" movement, the gynecologic picture interpreted in anatomic, physiologic, and associated pathologic thinking has markedly decreased the feared "Big Two" damage in total hysterectomy, namely, the ureters and the bladder.

We will attempt to show this in our discussion of the simplified technic used in total hysterectomy.

ESSENTIAL SURGICAL ANATOMY

The ureters in their entire transpelvic course are retroperitoneal. In the region of the adnexa the ovaries make a depression in the peritoneum called the fossa ovarii with the ureter as the posterior boundary. It is at this point that the ureters are not infrequently damaged while the adnexal portions are being removed. To avoid such possibilities the lateral masses must be elevated and separated from the posterior

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peritoneum and then, and only then, clamped and divided. Application of curved clamps to fixed lateral adnexal organs without preliminary separation may lead to ureteral damage. Ureters are damaged more frequently at this site than they are further down along the uterus and cervix.

As the ureter courses downward the uterine artery crosses over it at the lowest portion of the broad ligament. At this point it lies lateral to the cervix approximately a finger-breadth, or about 1.5 cm. away, where it courses further down and enters the urinary bladder posteriorly and obliquely.

The cardinal ligaments (Mackenrodt's ligaments) which are actually the lowest portions of the broad ligaments are the chief supports of the cervix and upper vagina. They are composed of connective tissue, muscle fibers and massive venous plexuses. These ligaments often give rise to a great deal of venous oozing if they are not properly clamped and transfixed. But caution must be exercised to avoid injury to the ureters while clamping the above ligaments. We always stay close to the cervix when applying the clamps and always converge the tip of the clamp toward the cervix proper. The transfixion needle should not take too much tissue in its bite. We frequently use the word "hug" the cervix to imply the closeness of the application of the clamps.

The cardinal ligaments continue posteriorly together with the uterosacral ligaments which form the chief support of the uterus and the cervix posteriorly. The latter must be dissected to liberate the cervix and the vagina for complete removal of the uterus. The urinary bladder is attached to the corpus uteri by fascial vesico-uterine ligaments and to the vagina by the vesicocervical ligament.

The peritoneal vesical reflexion on the uterus and the fascial connections must be pushed or rolled down medially to avoid bladder injury and pushed down laterally to reflect the ureters further away from the field of operation to avoid their damage. One can feel with the examining fingers the ureters at this point as firm cord structures. When the bladder and its fascial attachments have been reflected down past the cervix, the latter can be palpated easily and at this time the vagina is the only structure which is attached to the cervix.

TECHNIC

The patient is prepared for surgery in the manner suggested in our opening statement. At the time of operation either fluids or blood are administered intravenously. It is advisable and convenient to have the fluids running intravenously in the ankle but if the arm is used, use only the back of the wrist or the cubital fossa of the forearm. The arm must be next to and parallel with the patient. We have been using the Wells arm protector which has been very efficacious. Prior to its use we have seen two patients with temporary damage to the nerves in the brachial plexus with resultant transient paresis of the arm. This was due to hyperextension and extreme abduction of the arm by the inadvertent shifting of the surgeon or the assistant.

The patient is placed in a deep Trendelenburg position and if adequate surgical exposure can be obtained by an infra-umbilical incision, it is used. The incision must start on the skin covering the bony symphysis and not 1 or 2 inches above the symphysis at the hair line. In other cases, and there are many, it is necessary to extend the incision to the left of the umbilicus. The left side is used rather than the right side of the umbilicus to avoid the round ligament of the liver. If a patient has had a previous midline incision, we always excise the old scar and then extend the superior skin incision 1 or 2 inches longer. The peritoneal cavity is always opened above the linea semicircularis, and our preference is the superior angle of the incision. In a patient who has not been operated upon before we may avoid entering the urinary bladder, which may be congenitally high or be raised by a pelvic inflammatory process or an endometrio-

sis, neoplasms or a malignancy. We believe that it is very important to emphasize the fact that in a reoperative case the peritoneal cavity should be entered in the superior angle of the incision just below the point where the old skin excision was extended, thereby reducing the chance of bowel, bladder or omental injury. Additional points which will benefit the surgical exposure are: to incise the fascia down to and touching the symphysis pubis; not to stop in the inferior angle opening of the peritoneum when one ceases to see the translucency of light, but to feel for and make the incision of the peritoneum almost to the dome of the bladder.

The pelvis is cleared of bowels with warm lap pads in a roll-away fashion and then the corpus uteri is grasped with a tenaculum. In cases in which only the uterus is to be removed two straight hemostats are placed on the right and then on the left broad ligament in close proximity to each other pointing toward the cervix, with the inner one touching the uterus. These include the tube and the utero-ovarian ligament. An incision is made between them and the outer forceps is transfixed. The next two forceps are applied inferiorly and include the round ligament; the latter is divided and the outside one is then transfixed. This same procedure is continued on one side down to the corporocervical junction, and then the same procedure is accomplished on the opposite side. At this stage of the operation it is often possible to take off all of the forceps which were attached to the uterus for the purpose of controlling the backflow and keeping the field dry. A transverse incision is now made in the peritoneum just above the bladder. This is often simplified by picking up the bladder with a toothless tissue forceps and then making the incision in the peritoneum which reflects on the uterus. Occasionally, when dealing with an inflammatory process or an endometriosis (or even in an uncomplicated case), if one exerts rhythmical pressure downward, pushes the cervix down into the vagina and then exerts traction upward with slight extension on the peritoneal reflection, it will often simplify finding the exact attachment of the peritoneum and prevent potential urinary bladder injury. With the back end of a long tissue forceps, a cleavage plane is then found between the cervix and the uteropubic fascia, and this is reflected off the cervix and vagina together with the bladder. The direction of this reflection should be bilateral as well as inferior and in that way the ureters will be pushed to either side. A posterior transverse incision is then made in the peritoneum superior to the attachment of the uterosacral ligaments. We believe that the more peritoneum that is available posteriorly the less subsequent rigidity of the floor of the bladder and thereby less postoperative bladder symptoms which are occasionally seen after a total hysterectomy. The posterior peritoneum and uterosacral ligaments are then separated from the cervix and vagina. This high incision in the posterior peritoneum will also protect against possible injury to the rectum. The paracervical tissue or cardinal ligaments are then clamped with single forceps close to and hugging the cervix. This hugging of the cervix with the tip of the forceps pointing medially (converging) is another paramount factor in preventing ureteral injury. The above are then incised and transfixed down to the vagina first on one side and then on the other.

At this stage of the operation the only structure which is holding the uterus in the abdomen is the vagina. There are no clamps attached to any structures in the pelvis at this time thereby giving us a clear field to work in. Next two Boui rectal clamps are placed underneath the cervix on either side, an incision made above them and the entire uterus lifted out of the abdomen. The clamped vagina is now sewed with an over-and-over chromic No. 1 suture, and by rotation of the Boui clamps away from the bladder the vagina can easily be identified and the bladder not incorporated in this suture. The vaginal

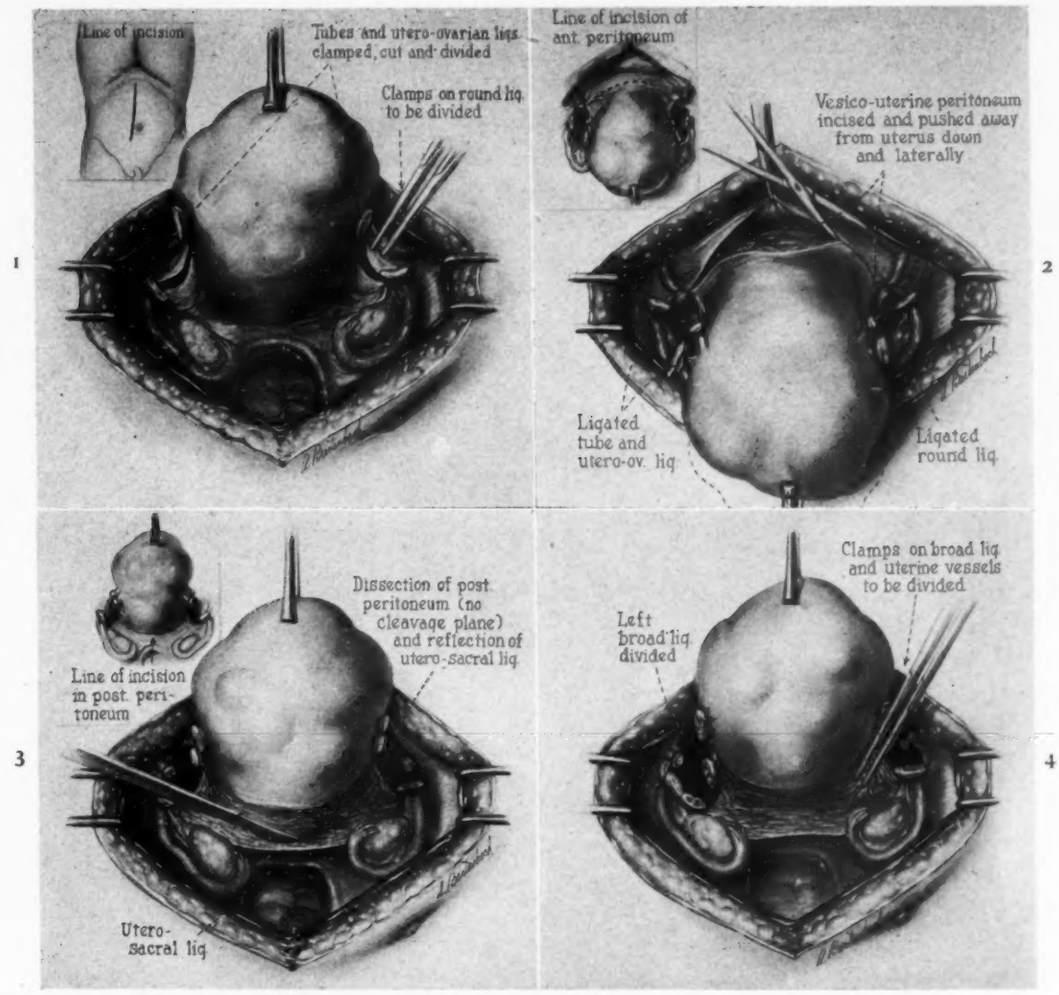
Line of incision
Tubes and utero-ovarian ligs. clamped, cut and divided
Clamps on round lig. to be divided
1
Line of incision of ant. peritoneum
Vesico-uterine peritoneum incised and pushed away from uterus down and laterally
2
Ligated tube and utero-ov. lig.
Ligated round lig.
Dissection of post. peritoneum (no cleavage plane) and reflection of utero-sacral lig.
Line of incision in post. peritoneum
3
Utero-sacral lig.
Clamps on broad lig. and uterine vessels to be divided
Left broad lig. divided
4

Fig. 1. Clamping and dividing of tubes, utero-ovarian and round ligaments.
Fig. 2. Reflection of vesico-uterine peritoneum downward and laterally.
Fig. 3. Dissection of posterior peritoneum and reflection of uterosacral ligaments.
Fig. 4. Division of the broad ligaments.

vault is supported by a silk suture posteriorly and anteriorly, to include the uterosacral ligament, the angle of the vagina and the cardinal ligament on either side. The round ligament is then sewed to the vagina on either side with a heavy silk suture, and the posterior peritoneum is sewed to the anterior peritoneum with interrupted fine silk sutures. The excess posterior peritoneum makes this subsequent peritonization free and non-rigid which, as we mentioned previously, is probably a factor in decreasing the number of patients who have bladder symptoms subsequent to hysterectomy. Two interrupted medium silk sutures are placed transversely into the uterosacral ligaments. The purpose is first, to prevent a potential enterocele which can be the etiology for a subsequent vault prolapse; second, it also has a tendency to keep the vagina more forward and third, it may be an additional factor in preventing the bladder symptoms of urgency and terminal dysuria.

If the adnexae are to be removed in addition to the uterus, we prefer to do the salpingo-oophorectomy prior to the start of the hysterectomy and transfix all clamps to give us a clear field to work in. However, in the case of pelvic inflammatory disease or endometriosis, it is often necessary to remove the uterus first thus giving the sur-

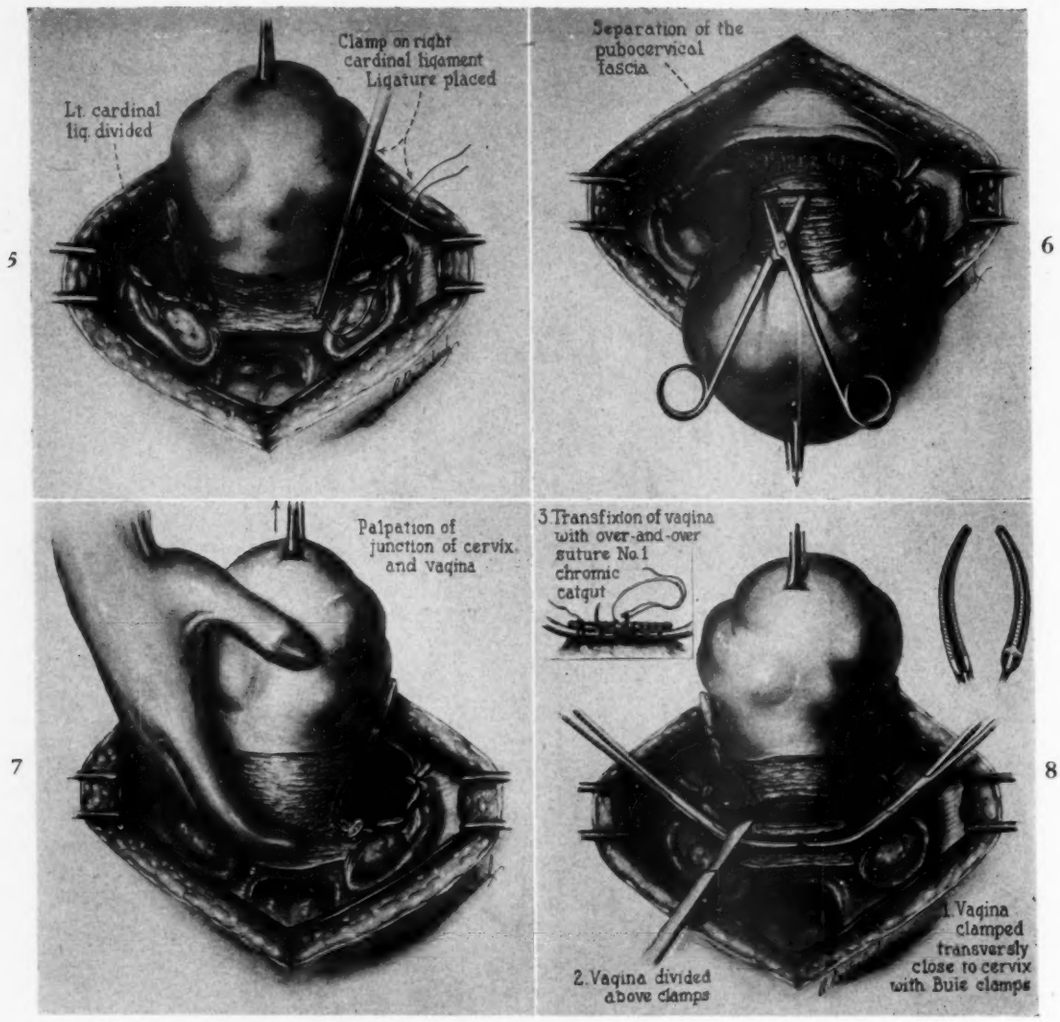
Clamp on right cardinal ligament
Ligature placed
Lt. cardinal lig. divided
5
Separation of the pubocervical fascia
6
Palpation of junction of cervix and vagina
7
3 Transfixion of vagina with over-and-over suture No. 1 chromic catgut
8
1 Vagina clamped transversely close to cervix with Buie clamps
2. Vagina divided above clamps

FIG. 5. Clamping of cardinal ligament.
FIG. 6. Separation of pubocervical fascia.
FIG. 7. Palpation of junction of cervix and vagina.
FIG. 8. Vagina clamped transversely with Buie clamps.

geon ample room and better vision to remove the adnexae with the accompanying adhesions. (Figs. 1 to 12.)

COMMENTS

We believe that with proper training of the surgeon complete removal of the uterus will eventually replace the subtotal operation. Not infrequently the question is raised regarding the depth of the vaginal vault after total hysterectomy. Is it shortened? What about dyspareunia, vaginal vault prolapse, the physiologic appearance of the vaginal mucosa, libido, urinary bladder dysfunctions, and mortality or morbidity as compared with the subtotal hysterectomy? These pertinent questions were answered as we followed many cases of total hysterectomies. The vaginal vault was not shortened if it was cut close to the cervix when the uterus was removed. Dyspareunia is another query of many doctors but here, too, in our series we did not see such a complication following the aforementioned surgical procedure.

We previously saw several patients with prolapse of the vaginal vault following complete hysterectomy. In the previously described method of vaginal vault support we have not as yet seen a prolapse in the cases we have been able to follow. Why the prolapse occurred may be difficult to

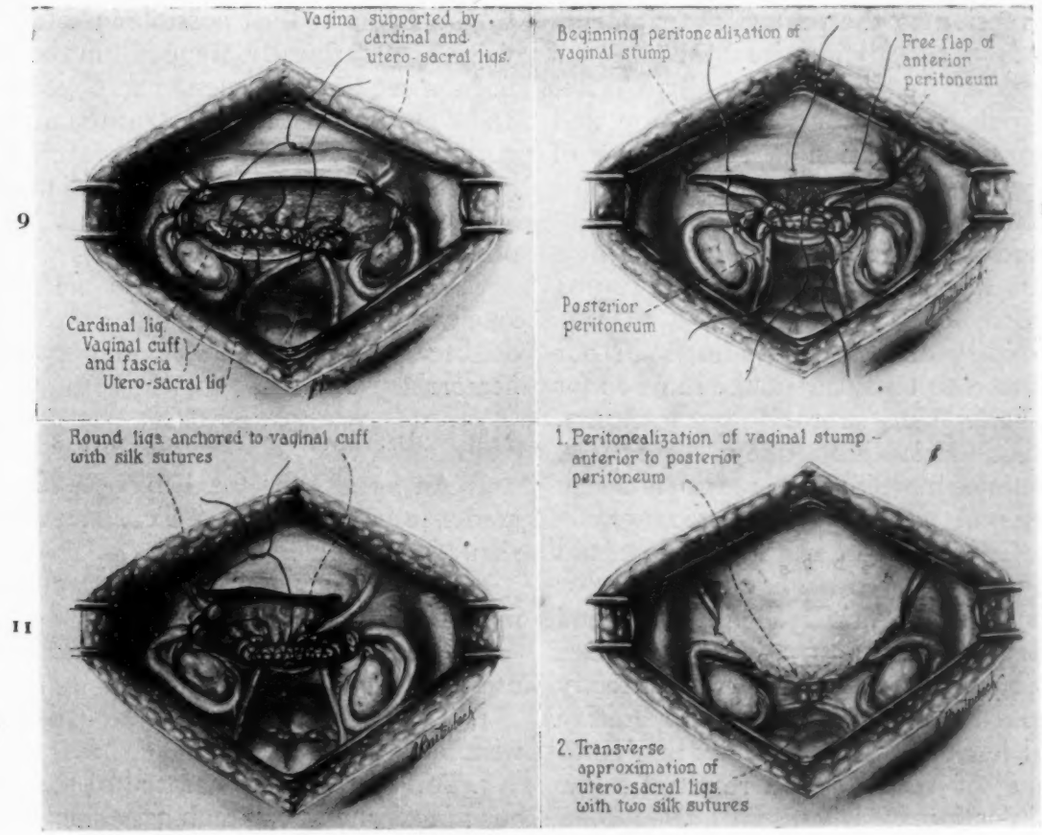
9
Vagina supported by cardinal and utero-sacral ligs.
Cardinal lig.
Vaginal cuff and fascia
Utero-sacral lig.
10
Beginning peritonealization of vaginal stump
Free flap of anterior peritoneum
Posterior peritoneum
11
Round ligs. anchored to vaginal cuff with silk sutures
12
1. Peritonealization of vaginal stump – anterior to posterior peritoneum
2. Transverse approximation of utero-sacral ligs. with two silk sutures

Fig. 9. Vagina supported by cardinal and uterosacral ligaments.
Fig. 10. Peritonealization of vaginal stump.
Fig. 11. Anchoring of round ligaments to vagina.
Fig. 12. Peritonealization completed; transverse approximation of uterosacral ligaments.

answer, but improper support of the vagina, poor inherent tissue tones or defective sutures, either due to a low grade infection or loss of tensile strength, may account for such a prolapse. Any one or a combination of the aforementioned factors may be responsible. We employ silk for vaginal vault support.

The vaginal mucosa alone following a total hysterectomy is not affected. It appears succulent, thick and moist. Even patients in whom the ovaries are removed at the same time fail to show any immediate evidence of atrophy, immediate meaning within one year.

Libido is a variable reaction among patients. Many describe a definite improvement which must be psychic, in that there is ease of mind in regard to conception; others are *status quo* as prior to surgery while a small percentage report some decline.

We have been aware for a long time that urinary bladder complaints following hysterectomies were a bothersome problem. Because of this, the urinary bladder proper and the peritoneal reflection of the bladder receive special handling and consideration. By pushing the fundus of the uterus and the cervix with the attached tenaculum down and up several times one can detect the bladder and peritoneal reflection in the uterus very easily. This establishes the exact urinary bladder peritoneal attachment on the uterus. The line of incision, therefore, is made high on the uterus, giving a free and a large peritoneal flap for future free peritonealization. This step prevents what is so frequently done, namely, to sew the bladder flap under too

much tension to the posterior peritoneum which is fixed, giving rise to elongation and rigidity to the bladder. The latter will produce symptoms of urgency and frequency of urination in the absence of urinary infections and without any organic disturbance. The transverse suturing of the uterosacral ligaments is also probably a contributing factor by holding the vagina forward.

Morbidity and mortality rates in our series are essentially about the same as for those undergoing subtotal hysterectomy. Early ambulation is routine in these cases. To minimize morbidity we routinely use in all cases of total hysterectomies 50,000 units of penicillin as the initial dose and 25,000 units every three hours for three or four days postoperatively. This may be and probably is an important factor to reduce the frequency of infection and indirectly will reduce the frequency of postoperative vaginal hemorrhage which may be due to sloughing of a suture as a result of a low grade infection.

As an additional and routine prophylactic procedure against possible infection the vagina is "surgically prepped" in the same fashion as the abdomen, namely, a soap and water scrub for a period of ten minutes with frequent flushing with water, then an alcohol rinse and finally it is painted any one of the popular antiseptics. We do not use iodine.

Use of gelatin or other absorbable styptic sponges over raw or oozing surfaces undoubtedly is also valuable in preventing hemorrhages.

SUMMARY AND CONCLUSIONS

1. An appeal for total hysterectomy is made. It is not new but a current discussion of the problem.

2. A discussion of pre- and postoperative measures is presented.

3. Reasons for complete removal of the uterus and cervix are discussed.

4. The technic of the operations is herewith outlined.

5. A discussion is presented of the various practical and common questions which are often raised by fellow colleagues.

REPAIR OF FASCIAL DEFECTS WITH WHOLE SKIN GRAFTS

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THE presence of fascial defects has presented a difficult problem to the surgeon. Various methods of repair of these fascial defects have left much to be desired. In the past attempts to eliminate these defects consisted of the use of a fascial graft or fascial strips. It has been found difficult to obtain either pedicle or free fascial grafts of homogenous fascia in sufficient quantity to obliterate large defects without creating a new defect or at least a weakening of the donor area. Probably the method which has been most applicable is the use of fascial strips as a lacing suture or weaving material similar to the mending of a hole in a sock.

Lack of abundance of fascial tissue and the difficulty of procurement of the grafts suggested a search elsewhere for a tissue that might be substituted for fascial tissue. It was believed that the substitute tissue should possess several characteristics peculiar to fascia and in addition be more readily obtainable, stronger, if possible, and more amenable to transplantation. The new tissue should have a good blood supply in contradistinction to the avascularity of fascia in order that a "take" would be insured in a high percentage of cases. It is not difficult to visualize, through elimination, that the only tissue that had most of the desired characteristics was the skin. This skin had been successfully grafted in the past to replace other skin and in deeper tissue to fill depressions. The dermal, fat and fascia grafts have been a part of the plastic surgeon's armamentarium when their employment has eliminated deep tissue defects and superficial deformities. As long as the asepsis was not violated these grafts took well. The superficial layer of skin was removed. This usually involved all of the stratum cornium and a most superficial portion of the stratum granulosum. This is a split-thickness graft of approximately 16/1,000 of an inch.

This type of graft (dermal-fat-fascia) was employed in one case in which there was a large soft tissue defect on the lateral aspect of the right thigh. The defect in the fascia lata was ovoid in shape measuring 15 by 10 cm. It was decided that a dermal-fat-fascia graft would best reconstruct and repair the defect. The defect was so large that it was believed to be necessary to raise two dermal-fat-fascia grafts from the anterior abdominal wall. These two grafts were sewn together with their synonymous layers in juxtaposition. The fascial layer was sutured to the freshened edges of the fascia lata defect. Recovery was uneventful until the twenty-third postoperative day. At this time there appeared an area of fluctuation in the region of the distal portion of the graft. An incision was made and it was found that the fascia was not healing to the surrounding tissue. The fascia was also separating from the fat of the original graft. The serum and fluid present suggested that the fascia and/or the fascia and the cotton sutures used in fixation was acting as a foreign body. The fascia was removed in the hope that the rest of the graft might be saved as both the fatty and dermal portions seemed to be viable. Three months later the fascial defect had become obliterated completely and the muscle no longer herniated through this region. However, there was a soft tissue defect residual with fixation of the skin to the subcutaneous scar tissue. The fixation was annoying

and the patient requested that the existing defect be corrected. Another dermal-fat-fascia graft was prepared. When the skin of the thigh had been dissected free of the subcutaneous scar tissue, there was found a definite layer of tissue firmly attached to the fascia lata that could have been no other than the dermal layer of the graft. It had made a firm and solid closure of the old fascia lata defect which had a resistance similar to the surrounding fascia. The more superficial defect was obliterated with the second graft which was made up of dermal and fat layers without fascia. This took successfully and the defect was completely alleviated.

This chance experience had opened a new vista and it had suggested a new tissue to be substituted for fascia in the repair of fascial defects. Apparently there was no need for the inclusion of the fascial layer in the dermal-fat-fascia graft. In fact, the inclusion of the fascia narrows the field open as the donor site and unnecessarily complicates the technical procedure. The dermal-fat graft or the dermal graft offers an ideal tissue which is easily obtainable in large quantities, easy to handle, about as strong as fascia and freer from complications.

The technic of obtaining the dermal graft more or less depends upon the existing defect that is to be repaired. However, there are certain general procedures that are applicable to the technic of obtaining any of the grafts. The preoperative preparation of the donor skin must be meticulous. The area should have a forty-eight-hour preparation with the following technic. The area is carefully shaved and scrubbed with green soap, water and a brush for a period of ten minutes. The soapsuds are then rinsed off with warm sterile water. Seventy per cent alcohol is applied. This is followed with ether. The area is then draped with a sterile towel which is held in place with a bandage. It has been found that mercurial antiseptics should not be employed in the preparation of skin that is to be used for grafting. The above procedure is repeated the next day and again at the operating table. After the patient has been draped and the recipient site has been prepared the initial 15/16/1,000 of an inch of the superficial skin, which includes the stratum cornium and a portion of the stratum granulosum, is removed by a Blair knife with attachment or a Paggett dermatome. The author prefers the use of the dermatome. The remainder of the dermus and the desired subdermal tissue is then excised according to the required pattern. The linear shrinkage of approximately 20 to 25 per cent must be taken into consideration when the pattern is laid out. The depth shrinkage is much greater than the linear shrinkage. It may be as great as 50 to 60 per cent. However, the latter type of shrinkage has a retarded nature as it is discernable only after two to three weeks after the placement of the graft. This shrinkage is directly proportional to the amount of fat that has been included with the graft. The defect in the donor area is closed by undercutting of the edges and by the use of retention sutures. It has been found that the deep Halsted type of retention sutures are most satisfactory. If the graft has been a large one, it may be necessary to roll the subcutaneous tissue into the defect after the undercutting has been carried deeper and toward the deep fascia. If the skin is under much tension, a complete closure with the retention sutures should not be attempted. After a partial closure has been made with the retention sutures the remainder of the skin defect may be covered with the split-thickness graft that was originally removed before the dermal-fat graft was raised. The author has employed cotton sutures throughout, No. 100 for bleeders and non-tension suturing and No. 36 for retention sutures. All surfaces are anointed with a thrombin solution. The split-thickness grafts are retained with Zeno adhesive or a modification thereof. They are never sutured. The use of any adhesive of this type necessitates a completely dry field. If the split-thickness graft has been permitted

to remain on the drum, there is no need for the use of saline and the graft will be dry when it is applied. A light coat of warmed sulfathiazole ointment 5 per cent is brushed over the graft or the area of closure. A sterile gauze dressing is applied and covered with sterile cellophane or wax paper. Fluffed gauze or mechanics waste is bandaged or strapped in place for pressure. This dressing is left *in situ* from ten days to two weeks unless the odor or a drainage suggests a catastrophe.

The technic of application of the dermal or dermal fat graft depends upon the requirements of the defect to be repaired. In all cases thrombin solution is used to anoint all of the contacting surfaces. The dermal edges are sutured to the freshened edges of the fascial defect. No attempt was ever made to fix the fat. A pressure dressing similar to that described above is employed in each of the ensuing cases.

Muscular herniations through the fascial defects of the extremities present a problem that pure fascial grafts do not successfully answer. Naturally smaller defects in the deep fascia, such as those occasionally seen lateral to the anterior crest of the tibia, may be caused when plicating the fascia with sutures. However, there may be a great deal of tension created which is unnecessary. There is usually a loss of subcutaneous tissue undoubtedly due to the pressure of the muscle that has herniated through the fascial defect. If the rupture is small, the superficial defect is readily obliterated by sliding the edges together with undercutting of the edges and retention sutures. However, if the defect is a large one, it is preferable to introduce the dermal-fat graft placed upside down.

This method in various ramifications has been employed in seventeen cases of muscular herniation in the extremities and other soft tissue defects of the extremities involving the deep fascia. Three of these cases were apparently congenital fascial defects as it was impossible to obtain a history of trauma either new or old. The remaining fourteen cases were definitely post-traumatic fascial defects (lacerations, gunshot wounds, etc.) with and without hernia.

CASE REPORTS

Case 1. W. S., age thirty-seven, sustained a gunshot wound of the left leg about 6 inches below the knee in November, 1942 that was débrided within two hours of the injury. Five days later a secondary closure was effected and the limb was immobilized in a long boot, circular splint of plaster of paris. After two weeks passed the wound was redressed through a window cut in the splint. The healing seemed to be progressing satisfactorily. After the termination of the eighth week when the splint was finally removed and the patient was permitted to stand without support, much to the surgeon's surprise there was a herniation of the fascia just lateral to the tibial crest about the size of a fifty cent piece. The decision to repair the herniation was made only because the patient complained of the disfigurement created by this herniation. There was no associated symptomatology. The dermal-fat graft was decided upon and the graft was obtained from the abdomen and it was placed fat-side externally over the defect. The dermal portion denuded down to and including the superficial portion of the stratum granulosum was sutured to the freshened edge of the fascial defect. The skin was closed and a mechanics waste pressure bandage supported by a light plaster boot was applied. The leg was redressed after the plaster boot had been bivalved on the tenth day. The healing seemed to be progressing satisfactorily. The bivalved plaster was replaced for support for the next three weeks. The plaster was removed daily for the purpose of giving massage and regulated active exercises. Warm whirlpool baths were instituted after the second week. After two months the defect was left unsupported and there was no suggestion of the herniation present.

Case 11. E. McC., age twenty-two, who received a shell fragment wound of the lateral aspect of the right lower leg mid-portion on June, 1944, represents a slightly different treatment of the soft tissue with fascial defect with the dermal-fat graft. As there was a large defect in the muscle in addition to the fascial defect a double dermal-fat graft was decided upon. Initial débridement of the wound with

removal of the foreign body had been effected less than an hour after the injury had been incurred. The patient came under the care of the author on the tenth post-traumatic day without any attempt at secondary closure. After the third day of penicillin lavage the granulations appeared contamination-free and the reparative operation was performed. The two dermal-fat grafts were obtained from the anterior abdominal wall. They were deprived of the superficial layers. The two dermal layers were placed in a juxtaposition with one pad of fat filling the muscular defect and the other making up the lost subcutaneous tissue. The whole area was then covered with the split-skin graft removed from the donor area initially. In this case thrombin and leukocytic adhesive was used after the formula of Dr. M. Zeno in the hope that the introduction of new blood supply would be enhanced where the multiple grafts were concerned. The two dermal-fat grafts took well but the center of the split-skin graft sloughed off. This slough was not surprising for the graft had been applied as a dressing for the area denuded of superficial skin. After the first eight days had passed there was a good base of granulation tissue in this area. After two days of continuous penicillin jelly (penicillin 500 units in quinolor jelly per 1 cc.) application with a pressure dressing, the granulations were pink and healthy looking. A second split-thickness skin graft was transplanted and this graft took without difficulty.

The case mentioned earlier in this paper of the large muscular herniation through the fascia lata is an example of the use of a double graft. However, the two grafts were not transplanted simultaneously. The other cases of this series are of sufficient simularity that it seems a definite waste of space to consider each of the cases singly.

The facility with which the dermal-fat grafts may be handled is surprising to the surgeon who has not employed this type of graft. The percentage of successful takes is high if absolute asepsis is maintained and the graft is carefully sutured in place.

Fascial defects of the abdominal wall in the thirty cases that have been repaired with the use of the dermal-fat graft fall into two groups; the repair of hernias and the initial repair of fresh defects.

Venteral hernia which is most frequently a postoperative or incisional hernia presents a large defect in the fascia which must be closed by the approximation under tension of the more or less attenuated fascial edges or closed by the introduction of new or transplanted tissue. If the defect is very large, it is nearly impossible to effect a solid and satisfactory closure with the introduction of a graft of tissue. With a graft, the tension factor can be eliminated and the end result lends a more insured success.

Case III. Mrs. E. I., age fifty-eight had had a laparotomy performed in 1932. She was found to have a large incisional hernia the size of a grapefruit in the lower right rectus region. The original incision apparently had been a lower abdominal right rectus incision. The abdominal skin over the hernia was laid back by a crescent incision over the median portion of the region of the protruding mass (the defect) and dissected free of the fat and scar tissue. The edges of the superficial rectus sheath were dissected free. The existing fibers of the attenuated rectus muscle were isolated from the fascia and scar tissue. The deep or posterior portion of the rectus sheath was separated as much as possible and the scar was excised with a small portion of the attached peritoneum. The peritoneum was then closed but it was impossible to create an approximation of the posterior rectus sheath without the sutures tearing out of the tissue due to the excessive tension required to effect the closure. The plan of operation had included the repair of the defect in the anterior rectus sheath with a dermal-fat graft, but it was not believed that it was possible to obtain an additional graft without difficulty. Strips of skin from the edges of the surgical incision were removed. The outer layers of the dermus were removed and the remainder of the strips were woven together to close the defect. The rectus muscle was replaced into its proper position and sutured lightly to the repaired area. A large dermal graft was prepared and raised. It was then placed into the defect in the superficial rectus sheath with the fat side upward and sutured to the edges of the sheath. The skin

was closed over the graft by sliding the edges together.

Case IV. Mr. H. K., age forty-four, presented himself September, 1940, two years after recovering from a posterior gastroenterostomy with a hernia about 6 cm. in diameter in the upper abdominal midline incisional scar. In view of the fact that this patient had little or no subcutaneous tissue, a dermal graft without fat was employed. This graft was sutured without tension into the defect in the interrectus apponeurosis. The herniation did not recur and after three months it was impossible to discover any suggestion of the old fascial defect.

Similar methods have been employed to repair defects in upper right quadrant incisions for cholecystectomy. The two following cases are among the cases of this series which were of a severe nature.

Case V. Mrs. B. G., age fifty-four, sustained an infected biliary fistula which followed an abscess that caused damage to a large portion of the operative incision which was of the oblique type following the costal margin. After seventy-eight days of irrigation had been prescribed with the adjunction of oral sulfa chemotherapy it was found necessary to excise a portion of the tenth rib which exhibited osteomyelitic changes on x-ray. Following operation, the drainage became minimized and it was believed that the remaining fistulous tract could be removed and the incision repaired. As a large portion of tissue had been removed and there was a wide separation of the incision borders the use of grafts was found mandatory. On the ninety-sixth original postoperative day the fistula and a large portion of scar tissue were excised. The peritoneum was closed with the aid of transplantation of the falciform ligament. A dermal-fat graft with only a thin layer of fat was sutured in place in the defect of the submuscular fascial tissue with the fat in juxtaposition to the peritoneum. The musculature was drawn together loosely. Another dermal graft without fat was used to complete the deep fascia. Both grafts were sutured to the periosteum and perichondrium of the tenth rib. The abdominal subcutaneous tissues and the skin were closed by a type of Szymanowski plastic flap transplantation.

Case VI. Mrs. E. E., age forty-one, had a large incisional hernia as a sequel to a cholecystectomy which had been performed in May, 1942. In December, 1943, the hernia was repaired. Again the falciform ligament was employed to eliminate in the peritoneum any tension that would have occurred if an attempt had been made at simple closure. A strip of skin with the superficial layers denuded was used to fortify the peritoneum. The muscle was closed by splitting and sliding together in the form of pedicles. A dermal graft was sutured in the deep fascial defect. The skin and subcutaneous tissue were closed by undermining the edges and the use of retention sutures.

The dermal or dermal-fat grafts have been employed to repair initial abdominal wall defects with fascial defects.

Case VII. Mr. H. C., age fifty-six, complained of pain in the upper left abdominal quadrant. He gave a history of attacks of indigestion for the prior seven to eight months. He had lost 68 pounds during this period. There was a mass about 5.5 cm. in diameter that was palpable in the left upper abdominal quadrant just lateral to the lateral border of the left rectus muscle. This mass seemed fixed to the abdominal wall. A barium enema revealed a defect in the transverse colon in this region. At operation it was found that there was a large tumor apparently arising from the wall of the transverse colon at the attachment of the mesocolon. This mass was also attached to the abdominal wall anteriorly where it seemed to be growing by contiguity. An anastomosis was completed in the transverse colon following removal of the tumor. It was necessary to excise a large portion of the anterior abdominal wall (about 7 cm. in diameter) in order to remove the tumor and the adjacent tissue. This procedure was closed with a free graft of omentum. The apponeurosis of the oblique muscles was repaired by a dermal graft. The skin was closed without difficulty as none had had to be sacrificed. The tumor proved to be a sarcoma. The patient was given a course of x-ray radiation. It is interesting to note that this therapy had no deliterious effect upon the graft so far as could be determined clinically.

Several inguinal hernias have been repaired with the aid of strips of skin used to fortify the fascia or by actual dermal grafts.

It is believed that an unusually strong repair may be effected in the direct inguinal hernias when the conversion of the direct hernia to an indirect hernia has been effected and the floor of the canal fortified by a graft of dermal tissue. The remainder of the repair may be completed by any of the accepted procedures.

The other cases of this series offer no other features that would make a recital of their case histories essential. Introduction of these histories would only progress toward a more definite realization that this method of fascia repair by dermal or dermal-fat graft is simple, certain and dependable. The technic of raising the graft and its transplantation is not frought with elaborate nor time-consuming methods.

CONCLUSIONS

1. The dermal or dermal-fat graft is an ideal tissue with which to repair fascial defects because it is obtainable in comparatively large quantities, easy to handle, about as strong as fascia grafts and less susceptible to complications.

2. These grafts may be employed to repair incisional hernias, inguinal hernias, muscular herniations of the extremities and initial fascial defects.

Radloff and King studied fifty cases of esophageal hiatus hernia and found that other diseases were also present in two-thirds of the cases (66 per cent) and that, in most instances the patients' symptoms were due to this concomittant disease. Surgery was needed in only three cases; undoubtedly, most of a patient's stomach may be up in her chest and still the patient never has any symptoms. I, personally, have encountered several such instances in which routine fluoroscopic examination has shown the existence of such a hiatal hernia without symptoms. The operation for repairing these diaphragms is not a simple one and should not be done unless urgent clinical symptoms are present. (*Richard A. Leonardo, M.D.*)

SIMPLIFIED TECHNIC FOR SUBTOTAL THYROIDECTOMY*

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REMOVAL of the diseased thyroid gland has been a challenge to the technical skill of surgeons for many years. The extreme vascularity of the gland, its proximity to the recurrent laryngeal nerves, and the intimate relation with the trachea, parathyroids and carotid sheaths have magnified the technical difficulties attendant to either partial or complete extirpation of the gland. All surgeons who see large numbers of thyroid abnormalities have devised various methods and have many technical details of their own. That numerous variations in technic still exist is not to be denied for every surgeon puts into his work the seal of his own individuality; consequently, divergence of details will always be found.

Only recently have there been a number of articles on the technical aspects of thyroid surgery from the large clinics over the country. We are proposing a simplified procedure, sound in principle and efficient in execution, the technic of subtotal thyroidectomy evolved by the senior author (U. M.) and used routinely on the Louisiana State University Surgical Division of Charity Hospital. In addition to other technical variations emphasis is placed on early division of the thyroid isthmus *en masse*, using specially designed isthmus clamps (Kuker) before directly attacking either lobe of the thyroid gland. A portion of the paper and illustrations will be given over to pertinent details which led to the design of the isthmus clamp, a description of the instrument and the rationale of its use in thyroid surgery.

On numerous occasions in the past it had been observed that division of the thyroid isthmus was very difficult with the available instruments; this was especially so in obese patients. Temporary respiratory embarrassment and tearing of the gland and contiguous structures, with consequent hemorrhage, were frequent complicating and occasionally lethal factors. Technical skill is in no small measure dependent on the surgeon's proper choice and use of instruments. In the past there was no recourse to an instrument which adapted itself to the maneuver of dividing the thyroid isthmus.

CLINICAL STUDIES

It is obvious from clinical inspection and anatomic measurements that the trachea forms a definite but varying angle with the anterior chest wall and especially with the manubrium sterni. To verify this angulation actual measurements were made on one hundred different patients. This procedure consisted of placing one limb of a modified protractor on the flat surface of the manubrium sterni and the other limb parallel to the anterior aspect of the neck with the patients in a relaxed supine position, using the suprasternal notch as the center point of angulation. This series of patients comprised a rough cross section of the various age groups and varied in build from thin to obese, both white and colored. There was a wide variance in the angulation, ranging from 25 degrees in the thin, flat chested patients to 65 degrees in the robust, obese patients, the mean average was 40.3 degrees. From these findings it is apparent that a straight instrument applied to the thyroid isthmus must be in addition to the difficulty encountered in applying the instrument cause excessive tension on the isthmus of the gland or impinge the jaws of the instrument into the adjacent tissues of the neck.

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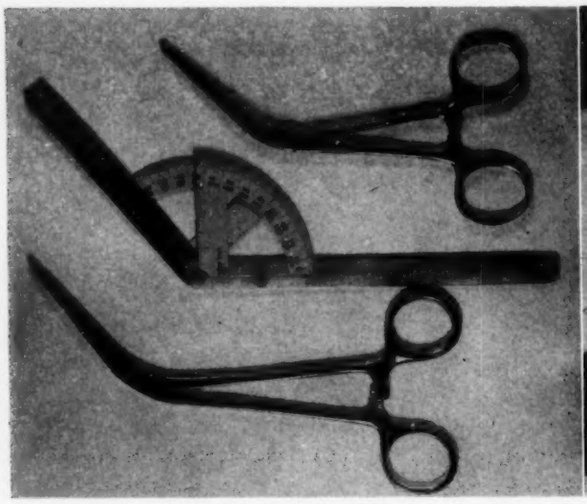

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FIG. 1. Forceps with modified protractor; angle of 50 degrees chosen to allow for finger grips on handles of instrument in addition to normal angle formed by the neck on the chest.
FIG. 2. Patient in position for operation; note angle of clamp coinciding with anatomical angle formed by the trachea on the manubrium sterni.

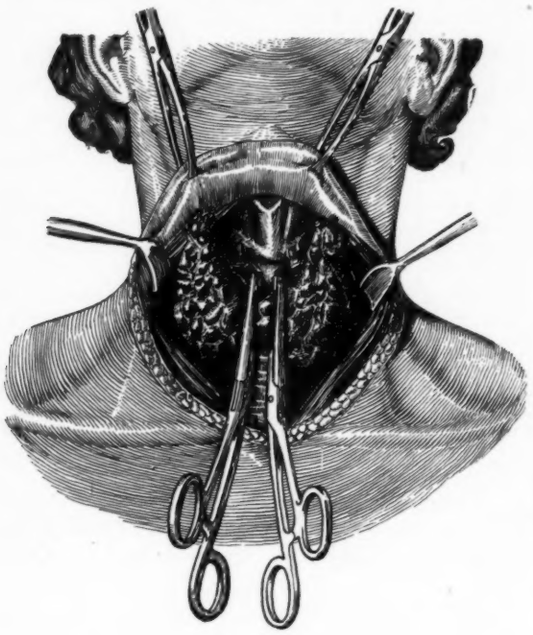
Instrument Design. With this information at hand, an instrument was devised with an angle of 50 degrees made by the jaws on the handles and in line with the handles. The center of angulation is located at the center pin of the joint, a smooth curve is formed and limited to the joint portion of the instrument. (Fig. 1.) This permits approximation of the jaws and handles of the instrument in a normal manner and yet retains the necessary stability of the joint. A second point of merit in design is the longitudinal arrangement of the serrations of the jaws with superimposed transverse serrations at the distal ¼ inch. The longitudinal lines prevent the grasped tissue from slipping from the side of the instrument while the terminal transverse lines prevent tissue slipping from the end yet avoiding the disadvantages of a tooth at the end of the jaws. The opposing margins of the jaws are rounded to avoid the sharp angular effect on compressed tissue; this reduces the likelihood of tearing or cutting the tissues held by the instrument. The value of an angulated instrument such as this in thyroid surgery is obvious. Principally, it allows for ease in application to the thyroid isthmus without undue or dangerous traction on the trachea. (Fig. 2.) Once the isthmus is divided and the trachea is free the operation may proceed at the surgeon's leisure and with a greater degree of safety to the patient.

TECHNIC FOR SUBTOTAL THYROIDECTOMY

Anesthesia and Positioning. The patient is placed upon the operating table in a supine position with the foot of the table 10 degrees lower than the head to allow maximum drainage of the venous system of the head and neck. The patient is given a general anesthetic of gas, oxygen and ether. A small pillow is placed beneath the shoulders to allow maximum extension of the head, thereby accentuating the thyroid region and increasing the distance from the suprasternal notch to the inferior surface of the mandible. The skin is prepared with ether and tincture of mercuric chloride over a wide area. A fluffed towel is placed on either side of the patient's neck, and the patient is draped exposing the neck region from the suprasternal notch to slightly above the hyoid bone.

Skin Incision and Flap. A collar type skin incision is made at the desired level, usually about 3 cm. above the suprasternal notch, following the wrinkles of the neck

which places the incision in the normal cleavage line. This may be marked with a string. The skin incision is deepened through the platysma muscle and superficial layer of the deep cervical fascia, extended laterally by blunt dissection and between the strap muscles of the neck is divided in the midline and the muscles are freed separately from the surgical capsule of the thyroid gland by curved Mayo scissors and blunt dissection; the sternothyroid is identified, brushed aside as part



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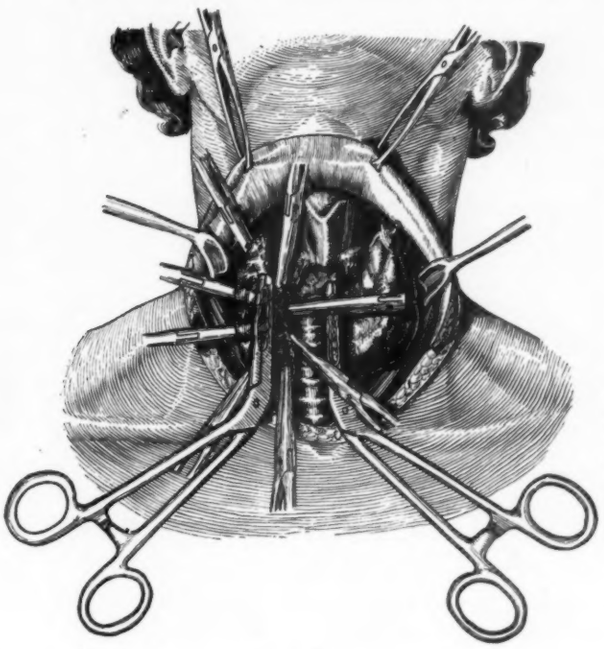

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Fig. 3. Drawing from photograph taken at operation; isthmus clamps in position preparatory to division of the thyroid isthmus *en masse*.

Fig. 4. Drawing from photograph taken at operation showing exposed anterior portion of trachea on rolling the isthmus clamps to the sides. Kocher clamps are placed to outline portion of thyroid to be removed by wedge-shaped excision after ligature of superior thyroid vessels. Clamps are removed as continuing suture of the capsule progresses.

cutting all layers simultaneously with a curved Mayo scissors. The anterior jugular veins are clamped and divided. The wound margins are draped with moist wash clothes and secured at either side of the neck with Smith hooks or Michel clips. All vessels clamped and divided are ligated with black silk No. C. The upper flap is freed by blunt dissection in the avascular tissue plane and reflected to the level of the suprathyroid notch. A blunt rake retractor is placed to retract the upper flap. The anterior borders of the sternocleidomastoid muscles are freed, permitting greater lateral retraction if necessary.

Exposure and Division of the Thyroid Isthmus. The middle layer of the deep cervical fascia forming the fascial bridge of the capsule and allowed to retract. This allows the gland to rise in the operative field giving greater exposure to the surgical capsule of the gland. The pretracheal fascia is divided above and below the thyroid isthmus and specially designed clamps (Kuker) are carefully introduced between the isthmus and trachea, the isthmus is clamped on either side of the midline with these instruments and divided *en masse* with a scapel between the clamps which further mobilizes the gland. (Fig. 3.) The handles of the angulated clamps are rolled laterally, peeling the isthmus from the anterior half of the trachea thus relieving any pressure produced by the isthmus and any tracheal compression which may have existed. (Fig. 4.) Resection of the lateral

lobes can progress with a greater degree of safety and without danger of respiratory embarrassment due to manipulation of the gland.

Management of the Superior Pole and Resection of the Gland. The lobe being removed is grasped with a Lahey clamp, pulled down with slight traction, lifted into view and rotated medially. The superior pole is freed by blunt dissection, and a curved Kelly or aneurysm needle is passed beneath the pole into which a black silk No. 1 ligature is caught and drawn about the pole and tied. A Kelly clamp is applied to the pole on the gland side of the ligature and the pole divided between clamp and ligature. With the lobe free and well exposed, the operator decides the amount of gland to be removed and outlines the remaining portion by application of Kocher clamps to vessels about the periphery of the gland. (Fig. 4.) The gland is cut away by shaving the clamps in a wedge-shaped manner and by so doing a dangerous area is avoided. Any vessels not caught from the periphery are caught as the gland is removed. This procedure leaves a portion of the gland along the posterior portion of the capsule. The recurrent laryngeal nerve is not visualized.

Suturing the Capsule. Instead of ligating each vessel and bleeding point individually, a continuous criss-cross suture of chromic No. 00 catgut is used and the clamps removed as the suture progresses. On the return suture an occasional bite of the tracheal fascia is included.

A dry sponge is placed in the side just completed and the same procedure is carried out on the opposite side. The operation is completed, sponges are removed, both sides are thoroughly inspected for hemostasis, and if the field is found to be dry, the wound is closed in anatomic layers without a drain.

Closure. The sternohyoid muscles are approximated in the midline with three to four interrupted sutures of black silk No. 1. Several subcutaneous interrupted sutures of black silk No. C are placed in the flaps which serve to approximate accurately the skin margins. The skin is closed with Michel skin clips placed about 3/8 inch apart. A dry dressing is applied and secured in place by one or two straps of adhesive which suspend from the back of the neck, cross and attach on the chest anteriorly.

COMMENTS

While cognizance is taken of controversy and differences existing at the present time on many of the technical aspects of thyroidectomy, we shall confine our comments to the surgical principles of the procedure as previously outlined.

Positioning of the patient is important both from the standpoint of immediate exposure and of postoperative comfort. Venous drainage of the neck is afforded with the head elevated. An interscapular rest or sandbag permits sufficient extension to give maximum exposure. Overextension of the neck gives rise to considerable postoperative discomfort in the occipital-cervical region.

General anesthesia is routinely used. A safe anesthetic is oxygen, ethylene and ether, and these are ordinarily preferred to other agents. An endotracheal tube may be employed; however, a tube gives rise to postoperative tracheitis, sometimes very severe, with resulting pulmonary complications. We believe that the dangers of not using a tube are, in the main, obviated by dividing the isthmus early, a step greatly facilitated by angulated isthmus clamps.

Outlining the proposed incision with a piece of suture material against the neck is an aid in making an incision which conforms to the natural skin lines in the neck. Bleeding is reduced to a minimum and the procedure expedited if after an initial skin incision with a knife, scissors are put through the platysma in the midline down into the avascular plane, inserted laterally and spread, and the skin and platysma tented with the scissors away from the underlying sutures and cut. Skin flaps are developed by blunt dissection and cleavage

planes are carefully followed. Better exposure is secured by partial freeing of the sternocleidomastoid muscles and division of the sternothyroid. There is no harm in leaving the divided ends unsutured. Because of the higher insertion of the sternohyoid, this muscle can be retracted satisfactorily except in very difficult cases. The sternothyroid on the other hand is in close contact with the superior polar vessels.

Division of the pretracheal fascia above and below the thyroid isthmus permits introduction of the specially designed clamps between the isthmus and trachea. The isthmus is divided between the clamps and the lobes freed, thereby relieving any possible tracheal compression or respiratory embarrassment and also permits access to the trachea in readiness for any eventuality.

The clamp described is specifically designed for the isthmus. Just as thoracic, abdominal and neurologic surgery require armamentaria peculiar to the various specialties, so does the anatomic configuration of the neck necessitate special instruments to accomplish efficiently certain phases of thyroid surgery. The thyroid gland is held down by the sternothyroid muscles and isthmus along with its attachments. The lobes of the gland, by the division of the isthmus after the sternothyroid muscles are removed as part of the capsule, become freely mobile, and this mobility allows the gland to be put under tension in any direction thus simplifying all the further steps in excision or resection of the gland.

The gland is removed with the exception of a v-shaped portion along the posterior capsule. This portion of the posterior capsule protects the inferior recurrent laryngeal nerve and the parathyroid glands and is not molested. The nerve is not demonstrated routinely.

A continuous suture incorporates the lateral and medial aspects of the capsule, along with the tracheal fascia, and is a very efficient hemostatic suture.

Closure is effected without drainage. Excellent cosmetic results are obtained with subcutaneous, fine black, silk sutures and Michel clips for the skin, one-half of which are removed in twenty-four hours and the other one-half in forty-eight hours.

SUMMARY

1. A simplified technic for thyroidectomy has been presented.

2. An angulated thyroid isthmus clamp has been introduced.

Acknowledgment: The authors are indebted to W. B. Stewart of the art department for his invaluable assistance in furnishing the illustrations used in this paper.

MANAGEMENT OF RECURRENT VARICOSE VEINS*

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A GREAT deal has been written about the initial treatment of varicose veins but little has been written about the treatment of recurrent varicosities. I would estimate that approximately one of every five patients who consult me for varicose veins have had some form of previous surgical treatment for this condition. Each of these patients presents a highly individual problem and the treatment must be based entirely on the reason for the recurrence. Heyerdale[1] and the writer have previously pointed out a number of the factors which were existent in recurrence of varicosities following treatment. We stressed the fact that when incompetency of the saphenous system of veins existed, and when simple injection treatment was carried out that a recurrence could be expected in most every patient. For this reason we were primarily interested in the factors which existed in recurrence when previous surgical treatment had been undertaken. At this time it was our belief that the majority of varicosities could be adequately treated by a combined division, ligation, and injection of the great saphenous vein at the saphenofemoral junction together with separate division and ligation of the uppermost tributaries. When incompetency of the lesser saphenous vein existed, this was also ligated just posterior to the knee. Subsequent injections were carried out to completely obliterate the remaining patent varicosities. There is no question in the author's mind that if this procedure is adequately carried out a great percentage of the patients with varicose veins can be properly treated.

Many of the recurrences seen today could be prevented if the many variations in the anatomy of the great saphenous vein and its tributaries at the fossa ovalis are recognized and adequately treated. Heyerdale[2] and the author have previously described a technic which has made it possible for us to expose adequately the incompetent great saphenous vein and its various tributaries. In many instances, recurrences were secondary to failure to ligate the uppermost tributaries with a resulting shunt around the site of ligation of the saphenous vein. In other instances the lateral or medial superficial femoral vein had been mistaken for the saphenous vein with resulting persistence of incompetency of the great saphenous vein following its supposed ligation. In others the saphenous vein was ligated at too low a level. In some instances anatomic variances in the tributaries was the explanation for the recurrence. In a few it was our belief that had a segment of the ligated saphenous vein been excised recurrence might have been prevented.

There are a number of other factors which could be mentioned, but of most importance has been the lack of adapting the original operation to the type of varicosities present and failure to consider the individual patient and his environmental problem. It was the author's belief at the start that most patient's varicosities could be properly treated by performing the aforementioned great and lesser saphenous vein ligation followed by an adequate program of sclerosing therapy. After observing these people throughout a number of years it became obvious to him that in a certain percentage it was almost impossible to completely eradicate these varicosities by this method. In another group permanent symptomatic and cosmetic results failed to be obtained. In still others this satisfactory

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result was obtained until the environmental or physical status of the patient changed. For example, the patient became pregnant. In still another group varicosities developed in portions of the venous system which had not been involved or previously treated.

From the patients' standpoint all individuals who developed varicose veins following any previous surgical treatment for such a condition must be classified as having recurrent varicosities. It is true that according to the author's grouping, a number of these individuals surgically should be classified as having (1) persistent varicosities, (2) recurrent varicosities and (3) newly developed varicosities. This is not practical so it is obvious that we are dealing with individuals who have had inadequate surgery at the time of the first treatment; individuals who have had adequate surgery but who as a result of either time, physical or environmental problems have had recurrences, or individuals who have developed new varicose veins. As one observes more and more of these people and studies the familial tendency he can predict the possible future course of his patient with varicose veins before any treatment is undertaken. With this in mind, the author selects with great care the operation, namely, a high ligation combined with sclerosing therapy; a high ligation together with segmental ligations; a complete or partial stripping operation; a classical high and low ligation together with sclerosing therapy or a ligation with segmental excision. In the past I believe that too little attention has been paid to the lesser saphenous vein, and a number of individuals that I have treated for recurrences had these because of incompetency of this vein.

It has been my observation that by selecting the operation which will most completely eradicate the patient's present, as well as his potential problem, that a number of the aforementioned recurrences could be prevented. In every instance the operation should be combined with sclerosing therapy. It has been my policy to look at all cases of recurrent varicose veins as untreated varicosities, and to treat these patients as was indicated anatomically. In some instances a little sclerosing therapy will be sufficient. In others if the original high ligation has been inadequate, it will be necessary to repeat this. If one or two communicating veins have become incompetent, a ligation of these, perhaps together with segmental stripping, may be indicated. In others a ligation of the lesser saphenous vein will suffice. In many of the recurrent problems, if it has been otherwise reasonable, I have been employing the complete stripping operation with removal of the entire great saphenous vein and, if indicated, the lesser saphenous vein.

In attempting to select the desired operation for these individuals there are a number of factors which influence me. If the patient is young and has already had considerable trouble from extensive varicosities with unsatisfactory results from a high ligation, there is nothing short of a stripping operation indicated. If there is a family history of considerable difficulty from varicosities and the patient has a fairly advanced condition, a stripping operation should be considered. Of course, in order to perform a stripping operation a general anesthetic, preferably spinal, is necessary. This means that the patient must be considered a minimal anesthetic risk. One must be careful to evaluate all of the associated vascular problems present as well as all of the general problems. Primarily, the treatment of varicose veins should be based on a symptomatic result rather than cosmetic. There are certain patients who must expect to retain a few varicosities if these are not producing symptoms. I do not mean to imply that everything reasonable should not be done to obtain cosmetic improvement but, for example, if one has, as I have at the present time, a patient aged seventy who has stasis ulcer associated with recurrent varicose veins, the indicated surgical treatment is that which will produce complete healing

of the ulcer and relieve the patient of his symptoms but which may not entirely eliminate all of his varicose veins. In this case I performed a segmental ligation of the saphenous veins, and even though his ulcer has been open for more than two years it is now healed at the end of three and one-half weeks. The patient who has large varicosities, who has had an old phlebitis which is not active at the present time, who has had much sclerosing therapy, who has had an ulcer which is now healed, or who has had an adequate high ligation with subsequent sclerosis and now has recurrent varicosities, is a candidate for a stripping operation. If the ulcer is active or if the stripping operation is considered too great a procedure for these individuals, a segmental ligation of the saphenous veins with some possible local stripping must be considered. This procedure, in contrast to the stripping, can be done entirely under local anesthesia.

When the varicosities are minimal and an inadequate high ligation has been previously performed with little or no subsequent sclerosing therapy, I perform a high ligation with sclerosing as previously mentioned. In others, with varicosities slightly more advanced and with a definite palpable saphenous vein below the knee, I usually perform a high and low ligation with subsequent sclerosis.

SUMMARY

For practical purposes all varicose veins which develop subsequent to any surgical procedure have been classified as being recurrent. These are considered and treated as primarily untreated varicosities. The operation to be performed is carefully selected for each patient and may be a high ligation with sclerosing therapy; a high ligation with segmental ligations; a complete or partial stripping; a high and low ligation with sclerosing therapy or a ligation with segmental excision.

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PROCIDENTIA

A NEW OPERATION TO CURE THE "REMAINING" PROLAPSED CERVIX OR VAGINAL HERNIA

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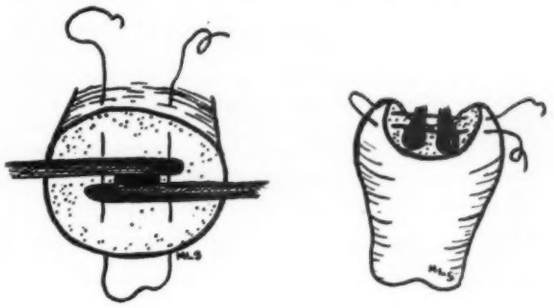
FOR the past thirty-five years I have made a careful study of the problem of prolapse of the uterus, bladder and culdesac tissues. I have written on this subject before[1–4] and in these writings have described certain new and original procedures that have produced most excellent results. In 1944 I last reported the results of a sufficient number of cases to justify conclusions and make valuable statistics. That study showed that the satisfactory results (to patient and doctor) obtained were about 99 per cent. Many have been added since, all private patients, and the results are still the same.

GENERAL CONSIDERATION

Subtotal Hysterectomy (Abdominal). The reason for mentioning this operation is to show its relation to the prolapse problem. I believe that many prolapsed cervices would not occur if a technically good abdominal subtotal hysterectomy was done at first. I mean that if the cervix is adequately and properly suspended (provided prolapse is not already present), many of the later prolapsed cervices would not occur. That can be done in only one manner and that is to bury the round ligaments into the open cauterized (Percy cautery) cut end of the cervix. This must be done before the cervix is closed. More than 90 per cent of surgeons and gynecologists, I have observed, still close the cervix and then attach the ligaments to the top. *This produces nothing but an adhesion.* Adequate suspension may be done in any manner the operator chooses, as long as the cervix is closed over the ligaments placed under fair tension. In my clinic I have evolved a simple method of doing this with a single continuous suture called the "crossover mattress technic." (Fig. 1A and B.)

I cannot conceive of a more adequate suspension than this and it has been reduced to such a degree of simplicity that I have done scores of those operations, including a general exploratory of abdomen with appendectomy in less than fifteen minutes. I mention this only to emphasize the simplicity of the abdominal subtotal hysterectomy with adequate suspension of the cervical stump.



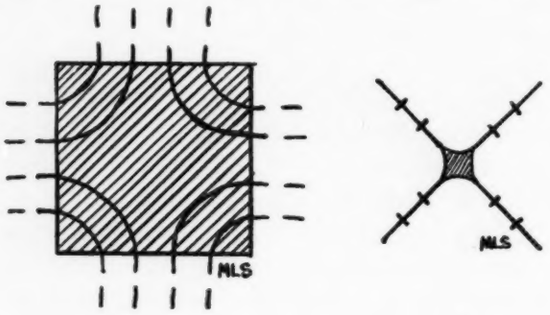
A B

FIG. 1. A, shows the single suture (double No. 2 chromic) technic for making an adequate suspension of cervix. Tubes are not included, only round ligaments. This is called the "cross-over mattress technic." B, transverse view shows graphically the position of round ligaments to be buried in cervix before tying. Bladder flap covers this area with a single suture if fastened low on posterior cervix.

Dealing with the Actual Prolapse. We divide the prolapse into (1) first and second degree which permits the cervix to come within 1 inch of the vaginal outlet when "squatting." (2) The third degree is at the outlet. (3) The fourth or nth is any degree beyond that. I want my readers to understand clearly before I proceed, that total vaginal hysterectomy plays no part in this surgical correction. I do not believe that

vaginal hysterectomy has ever been the proper procedure for prolapse.

Vaginal hysterectomy is a destructive procedure rather than a constructive one. It removes the only solid substantial tissue to anchor or support, viz., the cervix.



A B

FIG. 2. A and B, method of excising and suturing the redundant cul-de-sac or vaginal hernia tissues by abdominal route (cervix may or may not be present). The opening in the center is to receive the round ligaments as in Figures 3, 4, and 5, except all are done by abdominal route unless cervix is present. If cervix is present, do interposition of cervix by vaginal route after abdomen is closed.

After the cervix is removed there is nothing left but a hole. Converting this hole into the semblance of a vaginal canal suitable for coitus and giving a support to the anterior wall and bladder (cystocele) is a problem that has never been satisfactorily solved. As many as 1,500 of these operations have been done by a single operator but the results are far below 99 per cent. Several gynecologists report an average of 10 to 15 per cent of poor results. Again, nearly every operator has his favorite technic of doing his vaginal hysterectomy, which in itself justifies the conclusion that none of the technics is satisfactory. The cervix should be removed only rarely either by the vaginal or abdominal route. Cystic cervices may all be cleared up with the Percy cautery or fulguration at the time of operation. Surgery is not the treatment of choice of cancer of the cervix. Incidence of cancer of the remaining cervix should be less than on unoperated women if the cervix receives the proper cautery treatment at the time of surgery.

Removal of the cervix predisposes to cystocele. This seems to leave few, if any, specific indications for removing the cervix. Total hysterectomies take longer, are more dangerous to the patient, cause more danger of infection and give poorer support. Also operative and postoperative complications are more frequent. We, as teachers and instructors, should recommend to our students and postgraduate audiences the best procedure that will be safe in their hands. This point is frequently overlooked. Most of our series of vesicovaginal fistulas have followed total hysterectomy but few, if any, subtotal hysterectomy.[5,6]

SURGICAL TREATMENT OF PROLAPSE

I believe, and I have ample evidence to substantiate my opinion, that the interposition operation is the best technic to cure. It is one hundred per cent better because the uterus closes the opening through which the bladder protruded leaving room only for the urethra. It also removes all traction on the bladder neck and remedies leaking. By its extreme antiversion it remedies the second degree prolapse and leaves the cervix pointing toward the sacrum.

The Nth Degree Prolapse. In this surgical entity I will describe briefly the[2,3] Chaffin prolapse operation or specifically the *vaginal subtotal hysterectomy with transplanting round ligaments.*[1–4] I have improved slightly the "anchor" since my publication in 1944 by puncturing the posterior vaginal wall and passing a forceps up through the hole behind the cervix, grasping the ends of the ligaments, broad and round, and pulling the ends well down into the vagina, holding them tightly while suturing. Ends ½ to 1 inch long need not be excised as they will shrink into a hard, fibrous knot of tissue to assure a continuous support of the posterior vaginal vault. The hole is made close to the posterior surface of the cervix. (Figs. 3, 4, and 5.)

If there is a large redundant posterior vaginal wall, so-called vaginal hernia, we resect a portion of the redundancy by excising a rectangular piece of tissue ade-

quate to reduce the redundancy and close it by the four-corner suture method. (Fig. 2A and B.) We then pull the ligaments through and anchor them. The remainder of the operation is to do a typical classical interposition of the closed cervical stump. A perineorrhaphy completes the operation.

3 4 5

FIG. 3. Sagittal section shows graphically the round ligaments being pulled into the vagina through a hole behind the cervix. Sutures are placed at X, free ends protruding. Corpus has been removed vaginally thereby making round ligaments available for transplanting. This is the Chaffin operation for procidentia.

FIG. 4. Shows the round ligaments sutured into the fenestrated vaginal opening behind the cervix. The next step is the interposition suture through the pubovaginal fascia and closed end of cervix to close the "cystocele" space.

FIG. 5. Shows same as Figure 3 after ligaments have been sutured and the swelling and edema that follow, thereby assuring a permanent attachment. Cervix (internal os end) is closed and sutured beneath urethra as in interposition operation.

REMAINING PROLAPSED CERVICES FOLLOWING A PREVIOUS ABDOMINAL SUBTOTAL HYSTERECTOMY

During my nearly thirty years as Professor of Gynecology, I made it a point to ask all visiting gynecologists what to do with the prolapsed cervix. I do not recall ever getting a direct answer. That prompted and stimulated me to go to work on the problem. I believe that I have now solved it completely and have about sixteen cases all 100 per cent supported and without a failure. I believe that justifies a report and description of the technic.

I might dispose of the problem by saying that we do the Chaffin operation, one-half by the abdominal route and one half by the vaginal route. That is what we really do but in the following paragraphs I will attempt to make it a little clearer than I did in my last publication.

STEP BY STEP TECHNIC

1. Prepare patient's abdomen and vagina.
2. Trendelenburg position— 40 to 45 degrees.
3. Suprapubic laparotomy incision; wound towels—five-yard pack to empty pelvis.
4. Identify and grasp cervix with tenaculum.
5. Dissect bladder away from cervix and well down the anterior wall to vaginal wall.
6. Identify round ligaments and mobilize.
7. With tenaculum grasp culdesac posterior and close to cervix.
8. Incise (fenestrate) at this point into vagina.
9. Insert round ligaments into the opening while pulling up on vagina to make ligaments taut.
10. Suture well at these insertions with No. 2 chromic catgut.
11. Leave cervix free in the anterior position and cover with bladder flap.
12. Suture bladder flap at about the point of ligament insertion or farther if it will reach.

13. Close abdomen.

14. Lithotomy position; Gilpi retractor.

15. Incise anterior vaginal wall and cervix will be seen at once in this field.

16. Place classical interposition suture through pubovaginal fascia and thereby anchor the cervix under the urethra.

17. Close incision and operation is completed.

18. Perineorrhaphy if necessary.

19. Vaginal pack for one to two days.

The operation for the prolapsed vaginal vault in absence of the cervix is done entirely by the abdominal route: (1) Open the abdomen in 45 degree Trendelenburg position and identify the round ligaments which are usually retracted. (2) Grasp the apex of vaginal vault (nurse will push a blunt instrument in vagina to identify the "high point") with a tenaculum. Resect, if necessary, (Fig. 2A and B) and insert round ligaments (Figs. 3, 4, 5.) and suture. The bladder will also be supported by this technic. (3) Insert vaginal pack for a few days.

SUMMARY

1. A simple abdominal hysterectomy is described with an adequate suspension of the cervix.

2. Cystocele cure is assured by the interposition operation.

3. An nth degree uterine descensus is completely remedied.

4. The problem of the remaining prolapsed cervix is treated by a new original method with 100 per cent cures.

5 Vaginal hernia after total hysterectomy is cured by the technic herein described.

CONCLUSION

1. Abdominal subtotal hysterectomy is nearly always indicated for the usual pelvic disorder and more attention should be given the support of the cervix. Sew ligaments *into* not *onto* the cervix.

2. Vaginal subtotal hysterectomy gives far better physiologic and anatomic results than total vaginal hysterectomy. The statistics justify this statement. Vaginal hysterectomy does *not* cure the prolapsed uterus; it only removes it.

3. The vaginal subtotal hysterectomy is easier to do than the vaginal total. The average time it takes is about forty minutes including perineorrhaphy, the minimum fifteen minutes.

4 Approximately sixteen patients with prolapsed cervix and vaginal hernias have been operated upon by this technic and all have been cured.

5. To improve the over-all results in dealing with the procidentia problem, these two technics should be adopted by all surgeons doing this work, thereby reducing the 10 to 15 per cent failures reported by others.

6. The criteria for cure are: (1) A vaginal canal of normal depth permitting satisfactory coitus; (2) substantial anterior wall with no bladder bulging in the squatting position; (3) the culdesac occupies a high point to examining finger in the supine and squatting positions and (4) a vaginal canal normally lubricated by a normal cervical secretion is assured.

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USE OF CURARE IN THE ANESTHETIC MANAGEMENT OF THE PROFOUNDLY SEDATED PATIENT*

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THE purpose of this paper is to describe the use of curare in patients premedicated with large doses of morphine and scopolamine. The study is based on an evaluation of 446 cases; one hundred of these have been subjected to analysis.

The sedation in this series comprises two or three injections of morphine and scopolamine. Basal narcosis and total amnesia were the primary aims of this heavy medication. Although the amount of drugs used was regulated by careful observation of respiratory and pulse rates, it proved difficult to anticipate the individual responses of the patients, and many unusual problems were encountered by the anesthesiologist.

Upon arrival at the operating room the patients were drowsy or unconscious. A large percentage of them manifested an ideal reaction to the drugs and were easily managed by the anesthesiologist. They had normal or only slightly depressed respirations and normal pulse rates. Invariably, however, all of these patients were in a state of generalized increased muscular tone, and most of them showed a ballooning and loss of tone of the intestines. These two factors gave the anesthesiologist particular concern in the intra-abdominal cases.

A number of these patients were flushed, with a florid, slightly cyanotic appearance, a rapid bounding pulse of 110 to 160 per minute, showing evidence of cerebral irritation due to the large dose of scopolamine. They were readily aroused to slight or moderate delirium upon even the mildest stimulation.

Another group evidenced a drug imbalance with a preponderance of morphine depression signs. The respirations were decreased in rate, occasionally falling as low as 1 to 2 per minute. It often seemed that the surgeon could proceed with his operation without the aid of an anesthetic agent. However, patients forcibly resisted painful stimulation and lacked the cooperative ability accompanying consciousness.

Establishing surgical anesthesia and adequate relaxation in these semi- or completely unconscious, rigid patients proved a hard task with the anesthetic gases available. Cyclopropane was found to be unsatisfactory because it enhanced the already existing respiratory depression. The "controlled respiration" technic was precluded because of the possible difficulty in restoring the automaticity of respiration.

Ethylene-oxygen or nitrous-oxide-oxygen did not provide sufficient muscular relaxation, and the slow rate of respirations made it difficult to add enough ether to obtain the desired anesthetic depth.

Since November 1, 1944, curare has been employed in the anesthetic management of these heavily premedicated patients. This method of combating the undesirable muscular tension and of obtaining adequate relaxation has met with singular success and has become routine whenever large doses of morphine and scopolamine are used for preanesthetic narcosis.

METHOD OF ADMINISTERING MORPHINE AND SCOPOLAMINE IN DIVIDED DOSES AS PREANESTHETIC MEDICATION

The patients were premedicated in the manner described by Metz in 1936.[1] Two and one-fourth hours before the scheduled

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time for surgery the first hypodermic injection of morphine and scolopamine was given. The dosage was morphine 16 mg. (gr. ¼) and scopolamine 0.65 mg. (gr. 1/100) for normal adults of good vigor. The first dose was reduced if the patient was undernourished, debilitated or over sixty years of age. The second hypodermic was given forty-five minutes later. This consisted of morphine 16 mg. and scopolamine 0.65 mg., or morphine 10 mg. and scopolamine 0.5 mg., depending on the patient's vigor. The third dose was usually morphine 10 mg. and scopolamine 0.5 mg., administered forty-five minutes after the second dose, but was omitted if the patient was unconscious and did not respond to stimulation. One-half of the last dose was given if the patient was aroused with difficulty, the pulse rate below 100 and the respiratory rate above 10. In elderly patients the nurse was instructed to notify the anesthetist regarding the pulse and respiratory rate and the state of drowsiness before the second dose. In all cases the anesthetist was notified before the third hypodermic injection.

METHOD OF ADMINISTERING CURARE

The preparation of curare used was intocostrin,* and the concentration was 20 units per cc. The curare was administered by means of a simple infusion, consisting of a 5 cc. syringe, a two-way stop cock and a foot length of non-compressible small caliber tubing attached to a No. 19 gauge needle.

Routinely a 20 unit dose of curare was given intravenously immediately before the anesthetic mask was placed on a patient's face. This caused sufficient muscular relaxation to allow a quiet induction with ethylene or nitrous oxide and permit adequate oxygenation. When surgery was extra-abdominal, the original 20 units were complemented by 20 units for the average case. For the operations which required deep muscular relaxation, the primary dose was followed by 40 units five minutes before the anticipated time of the peritoneal incision. When relaxation was insufficient, an additional 20 units were infused and occasionally another dose was required for closure of the peritoneum.

* Extract of curare, Squibb.

TABLE I

LIST OF OPERATIONS IN THE SERIES OF ONE HUNDRED CASES

Type of Surgery		Percentage of Cases
Intra-abdominal		
Cholecystectomies	24	
Hysterectomies	19	
Appendectomies	15	
Bowel resections	6	
Abdominal explorations	4	
Salpingectomies	2	70%
Extra-abdominal		
Rectal operations	13	
Herniotomies	10	
Orthopedic cases	5	
Bronchoscopy	1	
Removal of cervical polyps	1	30%

In all cases studied the following technic of administration of the inhalation agent was found optimal. The induction was accomplished with 3 liters per minute flow of ethylene or nitrous oxide and 1 liter per minute of oxygen. After approximately three minutes the anesthetic agent was reduced to 1 liter per minute and this 50-50 concentration, assuring adequate oxygenation, was continued throughout the surgical procedure.

RESULTS IN ONE HUNDRED CASES

Table I shows the division of 100 cases into types of surgery performed. Seventy per cent of the cases were intra-abdominal interventions, the highest number being upper abdominal surgery. The average duration of anesthesia per case was eighty-four minutes, the shortest anesthesia lasting nineteen minutes and the longest two hundred forty minutes.

The patients ranged in age from seventeen to seventy-nine years, the majority of the group falling between the fourth and fifth decades. Thirty-five per cent were males, sixty-five per cent females.

Table II divides the patients according to the anesthesia risk, using the standard risk classification advocated by the com-

mittee of Records and Statistics of the American Society of Anesthesiologists, Inc. Sixty-eight per cent were in excellent condition for surgery. The poorer risks included asthma, bronchiectasis, cirrhosis of the liver, severe cardiac disturbance and diabetes.

TABLE II
DISTRIBUTION ACCORDING TO RISK (ONE HUNDRED CASES)

Risk	Per Cent of Cases
I	68
II	25
III	3
IV	1
V	2
VI	1
VII	0

TABLE III
PREMEDICATION DOSAGE RECORD

Morphine Sulfate (Mg.)				Scopolamine Hydrobromide (Mg.)			Per Cent of Cases
3 doses	16	16	16	0.65	0.65	0.65	1
	16	16	10	0.65	0.65	0.5	10
	16	10	10	0.65	0.5	0.5	19
	10	10	10	0.5	0.5	0.5	33
	10	10	8	0.5	0.5	0.43	4
	16	10	5.4	0.65	0.5	0.21	1
	10	10	5.4	0.5	0.5	0.21	1
2 doses	16	16	....	0.65	0.65	....	4
	16	10	....	0.65	0.5	....	9
	10	10	....	0.5	0.5	....	5
	10	8	....	0.5	0.43	....	3
1 dose	16	..	....	0.65	....	....	3
	16	..	....	0.43	....	....	1
	10	..	....	0.5	....	....	6

The amount of morphine and scopolamine used as the premedicant varied considerably. (Table III.) The maximum total dose was 48 mg. of morphine sulfate and 1.95 mg. of scopolamine hydrobromide. This amount was given to only one patient. Ten patients received 42 mg. of morphine and 1.80 mg. of scopolamine. Thirty-three per cent had a total dose of 30 mg. of morphine and 1.50 mg. of scopolamine. The minimum used was 10 mg. of morphine and 0.5 mg. of scopolamine which produced adequate amnesia and sedation in 6 per cent of the cases. The remaining fifty-one patients had amounts varying between the above figures. Sixty-nine per cent of the patients received three hypodermic injections, twenty-one per cent two injections and ten per cent, one.

Table IV presents the amount of curare administered in this series of one hundred patients. Eighty-one per cent received 110

TABLE IV
DOSAGE VARIATION IN THE SERIES OF ONE HUNDRED CASES

Curare		
Amount Used in Mg.	Per Cent of Cases	
20–30	1	
40–50	20	
60–70	15	
80–90	20	
100–110	25	
120–130	8	
140–150	8	
160–170	2	
180–190	1	Total 100%

units or less of curare, with a maximal dose of 190 units in one case, and a minimal dose of 20 units in one case. The degree of muscular relaxation attained was attested by direct observations of the anesthetists and by information requested from the surgeons. Ninety-three per cent were graded as excellent, three per cent as fair and four per cent as poor. The latter group occurred early in the series and was due to insufficient curare. Rectal surgery required more curare than other extra-abdominal cases (often 80 to 90 units) due to the marked stimulation during dilatation of the anus.

There were few untoward respiratory effects from the small divided doses of curare. The respiratory rate was not reduced beyond the preanesthetic level. Often, in fact, stimulation from surgery seemed to increase the rate and maintain a better tidal exchange. There were four instances of intercostal paralysis lasting five to seven minutes, accompanied by rapid shallow respirations. These were treated by amplifying the tidal exchange by manual compression of the breathing bag. Two patients had diaphragmatic muscle paresis which lasted five minutes. One apnea of five minutes' duration responded to inter-

mittent inflation of the lungs. In no case was it necessary to use prostigmine as an antidote.

There were two deaths in this series of 446 cases. One patient (risk 4) expired on the fourth postoperative day with a diagnosis of carcinoma of the pancreas and cirrhosis of the liver; the other died on the fifth postoperative day with a diagnosis of coronary thrombosis. There was one postoperative pneumonia with recovery, and one coronary thrombosis which occurred on the seventh postoperative day. This patient also recovered.

TABLE V
SUMMARY OF EVERY TENTH CASE IN THE SERIES
Typical Cases

Case No.	Type of Surgery	No. of Hypodermic Injections	Amount of Curare Used (mg.)	Length of Surgery in Minutes	Time from Completion of Surgery to Alert Response to Questioning (min.)
10	Appendectomy	2	100	33	95
20	Appendectomy and exploratory lap.	1	100	92	10
30	Appendectomy	3	80	47	5–10
40	Hysterectomy and oophorectomy	2	100	110	85
50	Removal of semilunar cartilage	2	60	54	40
60	Appendectomy	3	40	60	10
70	Cholecystectomy	3	100	92	135
80	Herniotomy	3	40	62	115
90	Hysterectomy	3	90	97	200
100	Hemorrhoidectomy	2	40	47	20

COMMENTS

Psychologically speaking, this combined method had much in its favor. Most of the patients had no recollection of the trip to surgery; in fact, few remembered the second hypodermic injection. After the completion of the operation they responded alertly to questioning in from ten minutes to three hours. (Table v.) For the next few hours they dozed quietly, responding when disturbed, but sleeping the rest of the time. They were very enthusiastic about this type of basal narcosis, and their statements that "we never even knew we had been to surgery" pleased surgeons and relatives. Sedatives or analgesics were seldom necessary during the entire postoperative period and complaints of pain were minimal. Parenteral fluids were never administered in surgery and seldom during convalescence. The patients usually took fluids freely by mouth as soon as consciousness returned. The average length of stay in the hospital compared favorably with that following other types of anesthesia.

The pharyngeal airway was easily introduced in light planes of surgical anesthesia, without illiciting spasm of the jaw or vocal cords. When curare was not used, trismus of the masseter muscles was often initiated by attempts to insert an artificial airway.

Poor risk patients tolerated well the combination of heavy sedation and curare. The asthmatic patients showed no increase in bronchiolar spasm in spite of the large preoperative morphine dosage. Patients with liver, urinary and cardiac disorders were apparently unaffected by the anesthesia, and the diabetic showed no evidence of acidosis.

The total quantity of curare per case was less than that used when the anesthetic agents were administered without the heavy premedication of morphine and scopolamine.

SUMMARY

1. Curare has been used as an adjuvant to gas anesthesia following preanesthetic medication of large doses of morphine and scopolamine in 446 surgical procedures since November 1, 1944. One hundred of these cases have been subjected to detailed analysis.

2. Small divided doses of curare adequately secured the desired muscular relaxation in 93 per cent of the cases studied. Seventy per cent of the cases were intra-abdominal interventions.

3. The total dose of curare per case was less than the amount required when heavy sedation was not used.

4. No contraindications to this method were noted.

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K. A. Kraft reports the use of intravenous procaine (1 to 1000 solution) in almost 900 operative patients in whom cyclopropane or other anesthetic was also given. He believes that this treatment prevents or/and effectively corrects any cardiac arrhythmias caused by cyclopropane and also makes it possible to obtain satisfactory anesthesia with a lesser amount of gas. Kraft has even used these intravenous procaine injections in the early postoperative period so that the necessity for opiates will be less. (*Richard A. Leonardo, M.D.*)

ANTERIOR DISLOCATION OF THE ELBOW WITH FRACTURE OF THE OLECRANON*

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ANTERIOR dislocation of the elbow is definitely a rare type of dislocation of the bones about this joint. Of the reported cases to date anterior dislocation alone is more common than anterior dislocation with fracture of the olecranon. A review of the literature up to the present time yields thirty-four reported cases, to which it is my desire to add another. The case to be reported is that of an anterior dislocation of the left elbow with fracture of the olecranon.

Although this type is not of the unusual anterior dislocation without fracture, only seven cases of dislocation with fracture have been reported up to this time. I agree with Cohn[1] and Jackson[2] that this condition presumably is not as rare as a review of the literature might indicate. Many cases have occurred no doubt but have not been reported. This case which is now added brings the total to thirty-five. Twenty-seven cases with anterior dislocation without fracture and eight cases with fracture of the olecranon are included. (Table 1A and B.)

TABLE 1A
CHRONOLOGICAL ORDER OF REPORTED CASES OF ANTERIOR DISLOCATION OF THE ELBOW

1. Evers	1787	15. Staunton	1905
2. Colson	1818	16. Winslow	1913
3. Leva D'Auvers	1842	17. Cohn	1922
4. James Prior	1844	18. Tees	1923
5. Monin de Mora	1846	19. Tees & McKim	1929
6. Guyat	1847	20. Tees & McKim	1929
7. Wittlinger	1848	21. Simon	1930
8. Ancelson	1859	22. R. Bonn	1931
9. Secreston	1860	23. Christopher	1932
10. Canton	1860	24. Oddone	1932
11. Gaussin	1861	25. McKim	1939
12. Hutchinson	1866	26. Jackson	1940
13. Fulton	1897	27. Mathewson	1940
14. Platt	1899		

This type of dislocation is barely mentioned by various authors in writing of injuries about the elbow. Callahan[3] and Chamberlain[4] mention the condition as very rarely occurring in dislocations about the elbow. Conwell[5] mentions anterior dislocation of the elbow, only to state that it is an extremely rare occurrence. He also

TABLE 1B
CHRONOLOGICAL ORDER OF REPORTED CASES OF ANTERIOR DISLOCATION WITH FRACTURE OF THE OLECRANON

1. Richet	1839	5. Mons	1877
2. Morel Lavalee	1858	6. Stimson	1899
3. Richet	1859	7. Batut	1910
4. Rigaud	1870	8. Strug	1946

states that the reduction accomplished is exactly the reverse of reduction of posterior dislocations.

In 1922 Cohn[1] published an exhaustive review of the literature and also reported an additional case. The literature in the nineteenth century is full of contradictions as to whether or not a forward dislocation at the elbow can occur without fracture. Boyer[6] stated in 1822, "We have never seen an anterior dislocation of the elbow complicated by a fracture of the olecranon." Gross[7] stated in 1859 that "anterior dislocation was believed impossible without fracture." Later events of recorded cases have certainly disproved both these assertions.

In 1931 Simon[8] also reported a review of the literature and added a case. Tees and McKim[9,10,11] have reported four cases on their service up to 1939. Jackson[2] in 1940 reported an additional case without fracture but complicated by a rupture of the brachial artery. Further evidence of the rarity of this condition is that in the x-ray service of Touro Infirmary, New Orleans, only two cases of this type have been seen during a period of twenty-five years, Cohn's[1] reported case without fracture in

* From The Department of Surgery, The Touro Infirmary, New Orleans, La.

1922 and the case herein reported with fracture of the olecranon.

MECHANISM AND PATHOLOGY

By far the majority of reported cases have occurred as a result of a direct blow upon the elbow. However, bizarre types of injuries may cause this type of disorder, as Gaussin's patient whose forearm was caught in a fly wheel. (This case was quoted by Cohn.[1]) However, most authorities do agree that a fall on the flexed elbow is the most likely cause of this type of dislocation. The pathological condition, as agreed upon by most authorities, is one of extensive lacerations of the ligaments about the joint, injury to the muscles about the joint and even going as far as separation of the muscles from the bony attachments. The resultant hemorrhage into the soft parts is severe and frequently calcification of the hematoma does occur even though accurate reduction has been accomplished.

The mechanism in those cases which have a fracture of the olecranon is readily understood. The resistance of the olecranon is removed so that the two bones of the forearm can be easily displaced forward. Actually these types of cases belong in a separate classification. Even so, the number of reported cases of this type are few.

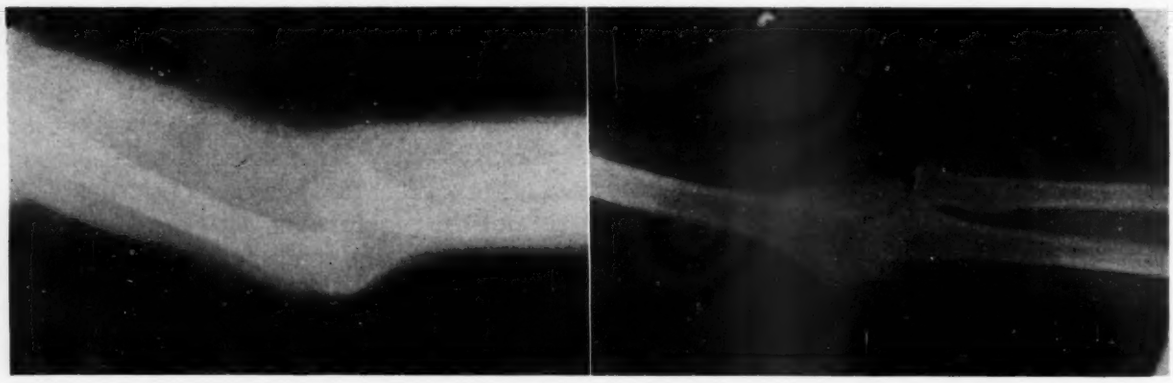
The consequence of this type of fracture and dislocation can indeed be serious. The blood vessels about the elbow joint can be badly torn, possibly resulting in gangrene of the forearm and necessary amputation. Three such cases are reported by Couton,[12] Morel Lavalee[13] and Rigaud.[14] Injury to the brachial artery may go unrecognized. Marnheim[15] in 1934 and Eliason and Brown[16] in 1937 called attention to the fact that the vessels about the elbow joint can be lacerated in posterior dislocation of the elbow joints. In Eliason's series[16] one patient died and one case resulted in ischemic contracture. That injury to the vessels does not occur more often is indeed surprising and can only be attributed to the marked elasticity of the vessels. That this injury to the vessels does occur in anterior dislocations is evident by the report of amputations in the early reported cases. Recently, Jackson reported a case of anterior dislocation of the elbow with rupture of the brachial artery. Fortunately for the patient, this complication was recognized early, the area explored, the severed ends of the artery sutured and reinforced with a venous cuff. An excellent result was obtained. Mathewson,[17] in his discussion of Jackson's paper, mentions another case of anterior dislocation of the elbow, with rupture of the brachial artery, which was successfully sutured after reduction of the dislocation was accomplished.

If following reduction the radial pulse does not return, one should suspect a possible injury to one of the major vessels about the elbow joint or the presence of a massive hematoma. Operative intervention should immediately be instituted, the clot evacuated and, if a severed or injured vessel is found, either primary repair effected or simple ligation of the severed ends performed. It also must be kept in mind that the absence of a radial pulse following reduction may be due to arterial spasm which has occurred as a result of the trauma. If no marked swelling or hematoma exists to indicate a lacerated major vessel, an upper thoracic and stellate sympathetic block may be of value in terminating the arterial spasm.

If reduction cannot be readily accomplished, one should suspect that the triceps tendon has been lacerated and the distal end of the humerus had buttonholed through it. McKim[9] reports such a case in which operative reduction was necessary. Cohn's[1] case also needed operative intervention to accomplish reduction as there was tearing and buttonholing of the triceps. This case was further complicated by fracture of both bones of the forearm.

CASE REPORT

S. R., a white male, age eleven years, gave the following history. While riding a two-wheel



1 2

FIG. 1. Lateral view of left elbow, showing anterior overriding of the ulna and radius upon that of the distal end of the humerus. The epiphysis and the proximal fragment of the olecranon are seen remaining posteriorly.
FIG. 2. Anterior view of the dislocation and the anterior position of the distal ulna.

bicycle on a paved street, he struck a hole in the street with his front wheel and was thrown from his bicycle, his left elbow striking against the trunk of a tree. He immediately experienced severe pain in the elbow which was excruciating with the slightest movement. He was seen in the Emergency Clinic at Touro Infirmary. Physical examination revealed a well developed, well nourished white male child who was in acute pain. His left upper extremity was held in extension with the forearm in supination. He supported the left upper extremity with the right hand. There was a marked concaval deformity on the posterior surface of the left elbow. The anticubital fossa was full and bulged. The entire elbow was markedly swollen. The bony prominence of the olecranon was absent, however, and the external and internal condyles were in their normal relation. Any attempt, no matter how gentle, to flex the forearm caused severe pain. Any attempt by the patient to pronate or supinate the forearm elicited severe pain. The radial pulse was readily palpable although somewhat diminished in volume as compared with the opposite extremity. The fingers of the hand were readily moved. No sensory disturbance distal to the elbow was noted.

The entire left upper extremity was splinted and the patient was brought to x-ray. Roentgen examination of the left elbow revealed an anterolateral dislocation of the elbow joint associated with a fracture of the olecranon process of the ulna. An angular shell of bone

FIG. 3. Anterior view of the same elbow following reduction. Normal anatomical restitution of the fracture and dislocation is seen.

FIG. 4. Lateral view of the elbow with the forearm in 90 degrees flexion showing the normal relationship of the bones about the elbow restored.

comprising the superior margin and upper portion of the posterior margin of this process were detached, maintaining their relations with the humerus, while the major forearm fragments were carried forward. (Figs. 1 and 2.)

Under ethylene anesthesia reduction was accomplished in the following manner: With an assistant exerting countertraction, steady traction was applied to the forearm. The forearm was then suddenly flexed, with pressure being exerted in the anticubital fossa, and the ulna was reduced without difficulty. The reduction was confirmed by immediate fluoroscopy. (Fig. 3.) The forearm was placed in 90 per cent flexion, with the forearm in mid-pronation. The radial pulse remained palpable following reduction. An anterior and posterior plaster splint was applied extending to mid-arm.

Roentgen re-examination of the flexed left elbow in plaster revealed perfect reduction of the fracture dislocation of the elbow joint which was previously described. (Fig. 4.) The arm was allowed to remain in the plaster splint for a period of three weeks. The splint was then removed and daily physical therapy instituted. Complete extension and hyperflexion returned slowly. The patient was discharged on January 24, 1947, with full return of function.

CONCLUSIONS

Anterior dislocation of soft bones of the forearm at the elbow is rare. This reported case brings the total to thirty-five which have, to my knowledge, been recorded in the literature. This case, however, does not belong in the pure type of dislocation, as it has an associated fracture of the olecranon. The damage to the elbow joint can be great, and one must bear in mind the possibility of rupture of the brachial artery; early operative intervention can save the extremity as has been proved in the past. Spasm of the artery may have resulted from the trauma and has been reported.

Reduction, judging from the reported cases and my own, has not been difficult unless the humerus has been pushed through an extensive laceration in the triceps tendon. Mobilization should be started early, between two to three weeks following reduction, unless there is an associated fracture of the radius and the ulna.

In the case reported an excellent functional and anatomic result was obtained.

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MIDDLE MENINGEAL HEMORRHAGE*

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EXTRADURAL hemorrhage of surgical proportions almost always results from injury to the middle meningeal artery. According to Munro it is present in 3 per cent of all cranial trauma. This important subject has been frequently and adequately discussed. However, in reviewing a recent series of our cases (Table 1) added data were found which we believe worthy of emphasis.

ETIOLOGIC CONSIDERATIONS

Our group of twelve patients were all males, ranging in age from seven to fifty-three years, with the surprisingly low age average of twenty-six.

The rapidity of development and the character of the clinical picture was related not only to the severity of the trauma but also to that part of the middle meningeal artery from which the hemorrhage arose. Thus six of our patients suffered relatively minor injuries such as a fall down the stairs, slipping upon an icy pavement, etc., and yet four of these had an extraordinarily explosive clinical course and a high mortality resulted in spite of what we considered prompt surgical attention. Our criteria of relatively minor cranial trauma are that the patients promptly and more or less completely recovered consciousness following the injury and there was little evidence of severe associated brain damage. Nevertheless when the main stem or a very large branch of the middle meningeal vessel was severed, the patient's life was threatened in a matter of hours.

Conversely six of our patients suffered what could be classified as severe cranial trauma: auto accidents, tree falling on head, etc., and in three of these the development of evidence of increasing tension was relatively slow. In each of these instances a relatively small branch of the middle meningeal vessel was involved. The severity of the associated cerebral trauma also served to mask, for a time at least, the evidences of increasing cerebral compression.

In all instances in which the point of trauma to the head could accurately be determined, the hemorrhage was found beneath this area. In most instances a horizontal linear fracture of the skull was recognized and proved to be the cause of the rupture of the artery.

SYMPTOMATOLOGY

The majority of our patients presented the classical picture of this disorder: an initial period of unconsciousness following the injury, succeeded by a lucid interval and a subsequent period of impairment of consciousness with focal evidence of cerebral compression such as a contralateral hemiparesis and homolateral dilatation of the pupil.

Eleven of the twelve patients were unconscious following the trauma. The twelfth patient was struck in the forehead by a back-firing crank handle without immediate loss of consciousness. The initial period of unconsciousness lasted from a few moments to as long as one to two hours. The more severe the injury, the longer the period of immediate unconsciousness. The severity of the syndrome of extradural hemorrhage was in no way related to the duration of the initial unconsciousness.

All patients had a lucid interval, the length of which in two instances was obscured by severe alcoholic intoxication. In the six patients whose course was very rapid and in whom a middle meningeal

* From the Department of Neurosurgery, University of Pennsylvania, Philadelphia, Pa. Read before The Philadelphia Academy of Surgery, April 7, 1947.

main stem vessel was found to be the bleeding point the lucid interval was consistently about one hour and the coma which followed was rapidly progressive being complete at two to two and one-half hours after the injury. In the six patients whose course was relatively slow and in whom a smaller branch of the middle meningeal vessel was found to be the origin of hemorrhage the lucid interval was generally

TABLE 1

Case No.	Age and Sex	Severity of Injury	Initial Unconsciousness	Lucid Interval	Focal Signs	Onset of Coma	Onset of Decerebration	Interval to Operation	Mid. Meningeal Vessel Involved	Result
1	32, M	Minor	Acute alcoholism	Acute alcoholism	?	?	?	Not operated	Principal vessel	Death on arrival at hospital 19 hr. after injury
2	21, M	Severe	10 min.	1 hr.	Ipsolat. dilated pupil and contralat hemiparesis	2 hr.	0	3½ hr.	Principal vessel	Recovered
3	46, M	Minor	Few sec.	1 hr.	Ipsolat. dilated pupil and contralat hemiparesis	2 hr.	Marked at 6 hr.	8 hr.	Principal vessel	Died in 24 hr.
4	7, M	Minor	Few sec.	1 hr.	Ipsolat. dilated pupil and contralat hemiparesis	2 hr.	Bilateral Babinski at 3 hr.	3½ hr.	Principal vessel	Recovered
5	33, M	Minor	Few sec. (alcoholism)	?	Ipsolat. dilated pupil and contralat hemiparesis	5 hr. maximum	Marked at 5½ hr.	8½ hr.	Principal vessel	Died in 36 hr.
6	9, M	Severe	30 min.	30 min.	Ipsolat. dilated pupil and contralat hemiparesis	2½ hr.	Bilateral Babinski at 2½ hr.	3 hr.	Principal vessel	Died in 72 hr.
7	17, M	Minor	0	24 hr.	0	0	0	-2 hr.	Small anterior branch	Recovered
8	53, M	Moderate	5 min.	38 hr.	Contralat hemiparesis	0	0	50 hr.	Small anterior branch	Recovered
9	31, M	Severe	1 hr.	2 hr.	Ipsolat. dilated pupil and contralat hemiparesis	0	0	30 hr.	Small posterior branch	Recovered
10	31, M	Severe	15 to 30 min.	3 hr.	Ipsolat. dilated pupil and contralat hemiparesis	0	0	22 hr.	Small posterior branch	Recovered
11	22, M	Severe	2 hr.	3 hr.	Dilated ipsolat. pupil	0	0	Not operated	Small posterior branch	Died—abruptly 10 days after injury
12	10, M	Minor	5 to 10 min.	1 hr.	Dilated ipsilat. pupil	Semicomat. at 6 hr.	Bilateral Babinski at 5½ hr.	8 hr.	Moderate sized posterior branch	Recovered

longer, one, two, three, three, twenty-four and thirty-eight hours, respectively. The two patients with prolonged intervals of lucidity were both instances of extradural hemorrhage from a relatively small anterior (frontal) branch of the middle meningeal vessel. All four patients in this group with more slowly progressive extradural hemorrhage but who had lucid intervals of only one to three hours had the hemorrhage occurring from a small posterior branch. However, in these patients the succeeding period of altered consciousness was only slowly progressive and complete coma never induced even as long as several days after the injury.

We do not wish to overstress the importance of the lucid interval by its presence in eleven of our twelve cases. We fully believe, as has been stated by Gurdjian and Webster,[1] that in severely injured individuals the deepening of an already unconscious state would be even more commonly observed than the lucid interval. However, in instances of relatively minor injuries as was the situation in many of our patients, one would expect the presence of a lucid interval to be invariable.

All of our patients with bleeding from the principal middle meningeal vessel had evidences of a contralateral hemiparesis and an ipsilateral dilated pupil when first seen by the surgeon. Neither of the two patients with hemorrhage from a frontal branch of the middle meningeal vessel had pupillary changes. On the other hand all four patients with a posterior branch middle meningeal hemorrhage had an ipsilateral dilated pupil and only two of these had a contralateral hemiparesis.

We wish to emphasize an interesting group of signs noted in some of our patients. These were in our opinion evidences of decerebrate rigidity: rigidity of all four limbs and neck with evidence of bilateral pyramidal tract involvement as indicated by the Babinski reflex and the presence of ankle clonus. Two patients definitely presented these signs and one of these even had "tonic fits" just prior to operation. Both were instances of main trunk middle meningeal arterial bleeding and both died in spite of successful evacuation of the hemorrhage at eight and eight and one-half hours, respectively, after injury. Three other patients had bilateral Babinski reflexes but no rigidity of the ipsilateral extremities. One was a deeply comatose child of seven, operated upon successfully three hours after injury and the main trunk of the middle meningeal vessel identified as the bleeding point. A second was a patient with hemorrhage from a large size posterior branch of the middle meningeal vessel in coma at the end of eight hours but nevertheless saved by operation. The third was a severely injured child in whom a large hemorrhage from the main middle meningeal vessel was evacuated three hours after injury. Unfortunately, death occurred abruptly forty-eight hours later from increased intracranial pressure and medullary compression following a lumbar puncture.

The cause of decerebrate symptoms is the herniation of the uncus of the temporal lobe through the incisura of the tentorium with pressure upon the mid-brain. Severe compression of the mid-brain undoubtedly causes hemorrhage into this vital area and the damage is now irreversible. That this occurs most prominently in temporal lobe mass lesions has been frequently and recently emphasized.[2] Extradural hemorrhage, particularly when resulting from rupture of the main vessel near its point of entrance into the cranium, exerts pressure principally upon the temporal lobe. The homolateral dilated pupil apparently results from this same mechanism, the third cranial nerve being exposed to pressure from the temporal uncus as it passes forward through the incisura of the tentorium.

The vital signs reflected the increasing cerebral compression. This was particularly true of the pulse which in the rapidly progressing cases invariably was below 60 per minute and frequently below 50. The respirations were not as consistently altered as the pulse and early were increased as often as slowed; although in those pa-

tients who died, the respirations were always rapid, deep and stertorous. The pulse pressure was generally increased due to an increase in systolic pressure. The increase in pulse pressure was generally of the magnitude of 20 to 40 mm. of mercury. The temperature early in the clinical course was elevated possibly one or two degrees, but terminally all moribund patients had a hyperthermia. The hyperthermia accompanied or soon followed the appearance of decerebration.

TREATMENT AND RESULTS

The only treatment is prompt evacuation of the hemorrhage. A subtemporal decompression is generally agreed to be the approach of choice: (1) It affords adequate exposure for evacuation of the clot and for control of the bleeding point. (2) It is a procedure rapidly accomplished with minimal operating room preparation. (3) It provides a decompression for postoperative cerebral edema and increased intracranial pressure.

The dura should be opened and the underlying cortex inspected. The presence of a subdural collection of spinal fluid, either clear or blood-tinged, beneath the area of extradural hemorrhage is not unusual. This was noted in four of our twelve cases and has been remarked upon by other observers.[1] Though the origin and significance of this subdural collection is not clear, it is often large enough to require evacuation. Other points in favor of opening the dura are that it provides better decompression for postoperative cerebral edema and makes possible direct observation of any cerebral contusion. Extensive cortical damage has therapeutic as well as prognostic significance. On rare occasions a subdural collection of blood may accompany an extradural hemorrhage.

Our series has led us to revise our opinions as to the rapidity with which the syndrome of extradural hemorrhage can progress and how truly prompt surgical intervention must be. In instances of rupture of the main stem or principal branch of the middle meningeal artery surgical intervention cannot hope to be successful unless instituted within three to six hours after the injury. Shortly after the third hour following the rupture of the principal middle meningeal vessel decerebration occurs. Thereafter it is probable the neurologic damage caused by the pressure of the hemorrhage is irreversible. We have had six patients in this category and only two survived. Both patients that survived were operated upon within less than three and one-half hours after their injury.

When only a small branch is the source of the hemorrhage, the surgeon is afforded considerably more time in which operation can be successful. In our series we had two patients the source of whose bleeding was a small anterior branch. In both the lucid interval had been prolonged (twenty-four and forty-eight hours) and operation was successful fifty and seventy-two hours after injury. In four patients the small vessel that had been opened lay posteriorly in the cranium. The lucid interval was short (one to three hours) but the succeeding period of altered consciousness was only slowly progressive and coma never occurred. Three were operated upon successfully eight to thirty hours after injury. The fourth of this group died unoperated upon owing to an error in diagnosis. The patient had never really become more than stuporous and his exodus occurred abruptly ten days after the injury.

In the entire series the operative mortality was 30 per cent, two deaths being instances of late operation upon main stem middle meningeal bleeding and the third operative fatality occurred as a result of severe associated brain damage. The case mortality was 42 per cent, there being two additional patients dying without operation. One of the nonoperative deaths has been discussed above as being due to an error in diagnosis and the other was an instance of bleeding from the principal middle meningeal vessel in a patient who was dead upon arrival at the hospital seventeen hours after injury. This mortal-

ity is in the range reported in recent years: Munro[3] reports an overall mortality of 55 per cent, Kennedy and Wortis[4] 72 per cent, McKenzie[5] 45 per cent and Gurdjian and Webster[1] 27 per cent.

SUMMARY AND CONCLUSIONS

1. The urgency for surgical treatment in cases of intracranial extradural hemorrhage is dependent upon the portion of the middle meningeal complex that is the origin of the bleeding and independent of the severity of the initial trauma.

2. When the origin of the bleeding is the principal middle meningeal vessel, the lucid interval is almost invariably one hour or less and the succeeding coma complete at two hours following the injury. Shortly after the third hour following trauma evidences of decerebration become manifest, which when full blown indicate that the neurologic damage to the patient is irreversible. Therefore, in instances of hemorrhage from the principal middle meningeal vessel operation must be undertaken within three to six hours of the injury if the patient is to be saved.

3. Bleeding from an anterior branch of the middle meningeal vessel is associated with a prolonged lucid interval of one to two days. The succeeding alteration of consciousness is not severe and only slowly progressive. Pupillary changes are not the rule though a contralateral hemiparesis may be present.

4. In instances of extradural hemorrhage from a posterior branch of the middle meningeal artery the lucid interval is generally of one to three hours' duration, but the succeeding state of alteration of consciousness is not profound and only slowly progressive. Ipsilateral dilatation of the pupil appears to be constant. A contralateral hemiparesis was present in only half of our cases of extradural hemorrhage originating from a posterior middle meningeal branch.

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MUCOCELE OF THE APPENDIX*

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MUCOCELE of the appendix, also known as pseudomucinous cyst or mucoid disease of the appendix, is a condition of a comparatively rare occurrence. Woodruff and McDonald[1] found 146 cases of cyst of the appendix in 43,000 appendectomies, an incidence of 0.3 per cent, at the Mayo Clinic. Similar tumors may involve one or both ovaries. When rupture of a mucocele of the appendix or ovary occurs, pseudomyxoma peritonei may follow although it is now known that it need not necessarily be a sequel of rupture in every case.

The condition was described in the appendix by Rokitansky in 1842 and by Virchow in 1863. Grodinsky and Rubnitz[2] produced it experimentally in rabbits by ligation of the base of the appendix after washing out the lumen and preserving the blood supply to the appendix at the time of ligation. Their work gives some clue as to the reason for the comparative rarity of the condition. It has been well demonstrated by Wangensteen and others that obstruction of the appendical lumen in the presence of pathogenic organisms produces acute appendicitis with perforation unless surgical operation intervenes. Apparently, in a few instances chronic localized obstruction of the appendix may occur in man without the presence of pathogenic bacteria beyond the point of obstruction, and in these few cases cystic distention of the distal lumen may occur.

The content of a mucocele is characteristically a jelly-like clear mucus. The mucus is said to be secreted by columnar cells lining the tubular glands of the mucous membrane. If secretion of mucus persists sufficiently, a cyst of the appendix may reach surprisingly large dimensions. Bunch[3] states that the size may approach that of a gravid uterus at term. In some chronic cases, calcium deposited in the cyst may cause sufficient deposition of radioopaque salts to warrant the diagnosis of stone by roentgen examination.

Rupture of a pseudomucinous cyst is not followed by the typical picture of peritonitis, inasmuch as infecting organisms are usually not present within the cyst. Rupture of a mucocele may, however, produce ascites because of blockage of lymphatics by the gelatinous contents of the cyst. It has already been observed that not all cases of rupture of a mucocele are followed by pseudomyxoma peritonei. Woodruff and McDonald believe that pseudomyxoma peritonei occurs in those patients in whom the formation of a mucocele is associated with grade 1 adenocarcinoma and that the mucus which may fill the peritoneal cavity in these cases is secreted by malignant cells which have escaped from the original cyst and become implanted at various points on the peritoneal cavity. They found adenocarcinoma grade 1 on microscopic examination of ten of the 146 cystic appendices studied.

The following is a case report of a case of pseudomucinous cyst of the appendix complicated by the presence of an acute gangrenous cholecystitis:

CASE REPORTS

CASE 1. The patient was a white male, age seventy-six. On admission he stated that he had pain in the abdomen for three days prior to admission. The pain was crampy in character and was accompanied by vomiting. After the onset of pain it became localized on the right side of the abdomen, particularly in the right upper quadrant. The bowels had not moved since the onset of this illness. The past medical

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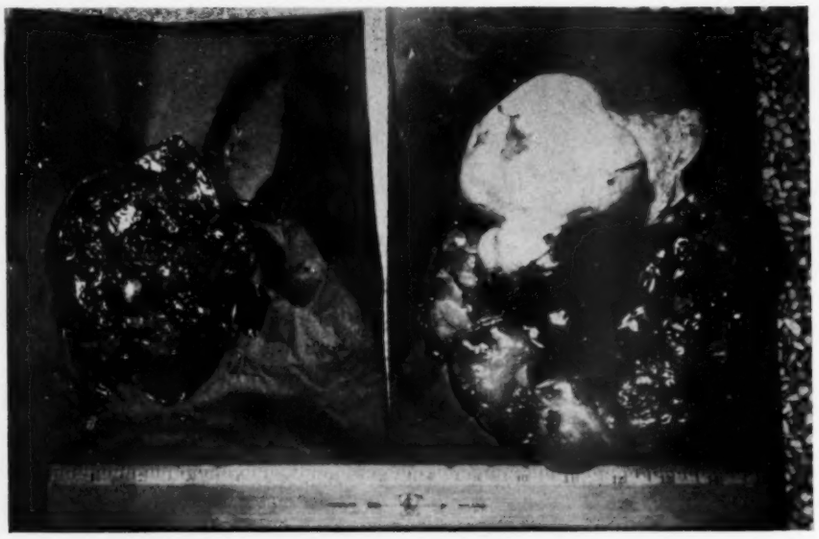

A B

FIG. 1. Case 1. A, acute gangrenous gallbladder; B, mucocele of the appendix showing a portion of the gelatinous contents.

history was insignificant except for a milder attack of pain and vomiting one year ago similar to the present attack. A physical examination revealed a slightly distended abdomen with very marked tenderness and a muscle spasm on the right side which was most severe in the right upper quadrant. No abdominal mass or tumor could be felt because of the extreme tenderness and muscle splinting. Although the admitting diagnosis was acute appendicitis, it was our belief that symptoms were probably due to acute cholecystitis. Temperature shortly after admission rose to 101.2°F. and gradually subsided so that operation was performed on the day after admission. The white blood count on the day of admission was 21,450, with 85 per cent polymorphonuclear cells.

On May 18, 1946, operation was performed under spinal anesthesia. On opening the abdomen through a lower right pararectus incision, a cystic mass the size of a grapefruit was found. This proved to be a mucocele of the appendix which had recently perforated, discharging some of the mucoid contents into the peritoneal cavity. Some of the small bowel in the region of the cyst showed a furry thickening of the serous coat where it had come in contact with the contents of the cyst. A culture of the cystic contents revealed no growth in seventy-two hours and no organisms were seen on direct smear. All the mucus that was in the peritoneal cavity was removed as completely as possible. The cyst was removed after clamping its attachment to the cecum, and the stump was closed with a continuous Connell suture of atraumatic chromic catgut reinforced by interrupted sutures of linen thread. Examination of the gallbladder then showed a very tense, thick-walled organ, so the incision was extended upward and an acute gangrenous gallbladder was removed. A Penrose drain was placed in the gallbladder bed but no drainage was used in the region of the mucocele. Convalescence was uneventful and the patient was discharged on the fourteenth postoperative day.

The pathologic report of the specimens (Fig. 1) by Dr. Helen Ingelby was as follows:

Macroscopically, 10 cc. of thick gelatinous yellow fluid with slight amount of blood was examined. The appendix consisted of a loculated cyst 12 by 10.5 by 5 cm. The smaller loculus was 6 by 4 cm. At the junction of the two was a papillary projection 1.2 by 1.5 cm. Two other small projections were found in the inner surface of the cyst. The cyst was filled with mucoid material. The cyst wall consisted of hyalinized connective tissue. What seemed to be the proximal portion of the appendix was found on one side of the larger cyst.

A piece of fat, apparently meso-appendix, was sent with the specimen. The fat appeared a little atrophic. The peritoneum over it was thickened.

The gallbladder had been opened. It measured 12 by 6 cm. The wall showed commencing gangrene throughout. Most of the mucosa had

been destroyed. In one place the wall appeared about to perforate. The outer wall of the gallbladder was roughened and showed purplish congestion with green discolored areas.

Microscopically, the projection into the appendix consisted of fibromuscular tissue covered by distorted glands. The glands contained enormous amounts of mucus. A few inflammatory cells were scattered through the wall. Some areas in the wall were undergoing mucoid degeneration.

A section of a small piece of mucosa near the cecum showed a few cecal glands and submucosal with a thickened muscular wall. The subperitoneal tissue presented many inflammatory cells and showed some hyaline and mucoid degeneration.

Cell block from the contents of the appendix showed inspissated mucin and a scattering of red cells.

The wall of the gallbladder was gangrenous throughout. Inflammatory cells were found in the surrounding fat and also an abscess.

The lymph node showed inflammatory hyperplasia of the reticulum with bile particles in the reticulum cells. Many of the germinal centers were necrotic.

Pathologic diagnosis: Enormous mucocele of appendix; gangrenous cholecystitis.

While in most instances the contents of a mucocele are sterile, a case rarely occurs in which infection is superimposed upon a mucocele. Such a case was encountered several years ago:

Case II. The patient was an obese male, age sixty, complaining of pain in the right lower quadrant for twenty-four hours. Several hours after the onset of pain he took a dose of magnesium sulfate and following this, became nauseated but did not vomit. His family physician was called and sent him to the hospital with a diagnosis of acute appendicitis. On physical examination he was found to be a very obese man with a thick panniculus. The blood pressure was 130/80 and the heart was found to be enlarged. Examination of the abdomen revealed a marked degree of rigidity in the right lower quadrant. The white blood count on admission was 16,000 with 82 per cent polymorphonuclear cells. The urine specific gravity was 1.025 with a trace of albumin and 4 to 6 red blood cells per high powered field were noted. Fasting blood sugar was 154 mg. per cent, and the blood and urea nitrogen was 26 mg. per cent.

An appendectomy was performed under spinal anesthesia on the day of admission and a greatly dilated appendix was removed. Grossly, the appendix was of the acute suppurative type, and there was much induration of the cecum at the base of the appendix so that the stump could not be inverted. The abdomen was closed without drainage. On the day following the operation râles were noted through both lungs with expectoration of bloody mucus. The patient was markedly cyanotic. Response to oxygen therapy and $\frac{1}{50}$ gr. of atropine sulfate hypodermically was poor and the patient died the following day. Autopsy revealed a very severe degree of myocardosis and it was noted that in the wall of the left ventricle the muscle was replaced by fatty tissue in many areas. There was no evidence of peritonitis.

The pathologic examination of the appendix was reported as follows: The appendix was 7 by $3\frac{1}{2}$ by 3 cm. and was filled with gelatinous material. A section of tissue was lined with multiple layers of tall columnar epithelium. Some of these simulated goblet cells. The subepithelial zone contained a thin layer of circular involuntary muscle. The lumen was filled with a copious amount of mucoid muscle. Interspersed throughout were a large number of polymorphonuclear lymphatic and mononuclear cells. Involuntary muscle showed hyaline changes. Inflammatory exudate cells were arranged in bundles and were surrounded by areas of necrosis.

Diagnosis: Acute suppurative mucocele of the appendix.

A third case is interesting because it is somewhat different from the two previously noted and introduces another possible cause for the formation of mucocele:

Case III. The patient was a man, age thirty-nine, admitted to the Jewish Hospital on March 22, 1935. Six months previously he had undergone drainage of an appendical abscess without removal of the appendix. He was advised to return at a later date for an appendectomy. On the day after his readmission the appendix was removed under spinal anesthesia. The postoperative course was uneventful.

Macroscopic examination of the appendix showed it to be 6 cm. in length by 3 cm. The

serosa was smooth and the muscularis slightly thickened. The mucosa was pale, and the lumen contained gelatinous material.

Microscopically, a section of the appendix showed marked dilatation of the lumen, which was lined with a single layer of columnar epithelium of the goblet variety. The nuclei were located at the base of the individual cells. The glands of Lieberkuhn were diminished in number. No distinct lymph follicles were seen. A small number of lymphocytes were observed in the mucosa but the muscularis and serosa were normal.

In this case it is possible that a mucocele was present at the time of the original attack of acute suppurative appendicitis with perforation and subsequent abscess formation. However, it seems more probable that the mucocele formed subsequent to the burning out of the infection in the appendix, and this may be cited as an additional source of mucocele formation.

SUMMARY AND CONCLUSION

1. Mucocele of the appendix is a relatively uncommon tumor. It may be asymptomatic for years. Our experience would indicate that infection may be superimposed upon a mucocele and give symptoms similar to those of acute appendicitis. Rupture of a mucocele may occur without acute infection as a result of overdistention by the mucus contents.

2. Theories as to origin of mucocele of the appendix have been reviewed.

3. Three cases of mucocele of the appendix encountered in the past ten years have been reviewed.

4. Pseudomyxoma peritonei was not observed as a complication following removal of the mucocele in any of these cases.

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GLOSSOPHARYNGEAL NERVE BLOCK*

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INTERRUPTION of the glossopharyngeal nerve by the deposition of local anesthetic solutions is useful in the accurate diagnosis of tic douloureux or neuralgia in which this nerve is involved and in providing anesthesia for operative intervention upon the posterior third of the tongue. This discussion will include a technic for completing glossopharyngeal nerve block safely and effectively, a résumé of the pertinent anatomy and descriptive case reports.

The most common method hitherto employed for anesthetizing the peripheral glossopharyngeal nerve supply was that of Labat.[1] It is accomplished by a fan-wise field block performed by inserting a needle just above the mid-point of the hyoid bone and injecting against the tip of the finger which is placed against the base of the tongue near the epiglottis. The maneuvers performed are time consuming, uncomfortable for the patient and fail to provide adequate anesthesia in most instances. A simpler and more efficacious interruption of the glossopharyngeal nerve pathways is desirable.

ANATOMY

The glossopharyngeal nerves are paired, mixed cranial nerves. Each is attached to the medulla by several roots which enter the posterolateral sulcus, dorsal to the anterior end of the olivary body. These filaments blend laterally into a trunk in front of the vagus. The nerve leaves the skull through the jugular foramen with the vagus and accessory nerves. It is enclosed, however, in its own sheath of dura mater. After emerging from the jugular foramen, the glossopharyngeal nerve descends between the internal carotid artery and the internal jugular vein to the lateral side of the vagus. It then passes medial to the styloid process and anteriorly to the lower border of the stylopharyngeus. (Fig. 1.) After winding around the latter it extends forward between the internal and external carotid arteries, following the upper border of the middle constrictor medial to the hyoglossus and enters the pharynx where it spreads out over the posterior third of the tongue in the submucosa.

The glossopharyngeal nerve supplies a motor branch to the stylopharyngeus and joins the pharyngeal plexus to which the vagus and sympathetics also contribute fibers to supply sensation to the pharyngeal walls, tonsils and soft palate and is thus implicated in the initiation of the swallowing reflex. It terminates in the posterior third of the tongue as fibers which subserve sensation and taste from this area. The other branches of the ninth nerve are not a direct concern of this discussion.

TECHNIC

The presence of constant deep and superficial landmarks, preferably bony prominences, aid in the accuracy and success of nerve blocking. The technic to be described includes reliable bony landmarks throughout. The external reference points are illustrated in Figure 2 and the precise locus of anesthetic interruption in Figure 1.

The patient is placed in the supine position and the head turned toward the opposite side to about 45 degrees with the sagittal plane of the body. The tip of the mastoid bone is then identified and marked with a skin pencil. The angle of the mandible is also located and marked. A line is drawn connecting these points and is then bisected. A skin wheal is raised at the mid-

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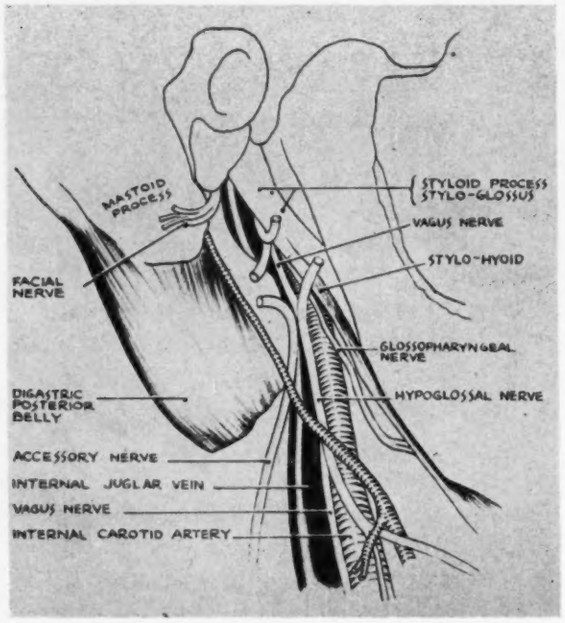

FIG. 1. A diagrammatical representation of the essential anatomic relationships of the glossopharyngeal nerve.

FIG. 2. The cross indicates the site of the skin wheal used for glossopharyngeal nerve block.

point of the line joining the mastoid tip and the angle of the mandible. Contact with the styloid process is effected by inserting a 5 cm. fine caliber needle through the wheal in a direction vertical to the skin. After the styloid process is encountered at a depth varying from 2 to 4 cm. medial to the skin surface, the needle is reinserted in a manner which permits the point to pass 0.5 cm. deeper and posterior to the bony styloid. The needle point then lies immediately adjacent to the glossopharyngeal nerve and injection is completed very slowly after careful aspiration. A total of 4 to 8 cc. of 1.5 per cent procaine solution on each side will provide adequate anesthesia of the posterior third of the tongue for approximately seventy-five minutes.

Although theoretically probable, concomitant block of the facial and vagus nerves has not been observed. Injection into a major blood vessel can be avoided uniformly by careful and repeated aspiration during the procedure.

The technic described has been successfully completed for anesthesia to facilitate surgical procedures upon the tongue and as a diagnostic procedure to select patients for intracranial ninth nerve section.

CASE REPORTS

CASE 1. G. R., sixty-one year old white male, was scheduled for insertion of radium into the posterior third of the tongue for the treatment of carcinoma of this region. The patient had advanced arteriosclerotic heart disease and had experienced congestive heart failure. There was a secondary anemia of 2.5 million red blood cells and an hemoglobin of 7 Gm. per cent. The planned surgical procedure was expected to require approximately sixty minutes of anesthesia.

Premedication consisted of pentobarbital 0.1 Gm., morphine 0.01 Gm. and atropine 0.0004 Gm. thirty minutes prior to anesthesia. Bilateral glossopharyngeal block was performed in the manner previously described. Operation was begun fifteen minutes later and continued for a total of seventy-five minutes with complete comfort to the patient and no significant change in his condition. The surgeon experienced no technical difficulties in his manipulations.

Case II. H. B., was a sixty-five year old male, with leukoplakia of the tongue most marked on the right side. He experienced constant severe burning pain in the tongue, markedly aggravated by talking and chewing. There was evidence of a marked loss of weight recently due to inadequate food intake. There was difficulty in evaluating the presence or absence of pain on swallowing. The tongue was uniformly tender to touch.

Bilateral lingual block with 1.5 per cent procaine was performed as a diagnostic measure. Pain relief in the anterior portion of the tongue was immediate but symptoms in the posterior third were unchanged. It was noted at this time that swallowing was significantly painful. The right glossopharyngeal nerve was then blocked during the period of lingual analgesia and all symptoms were alleviated. Pain recurred in approximately three hours. Therefore, the patient was referred to the Neurosurgical Service for surgical interruption of the glossopharyngeal and trigeminal nerves. Intracranial section of these nerves was performed on the right side to secure prolonged symptomatic relief. Postoperative review for approximately two months found the patient free from tongue pain except for a small area on the left side. Appropriate anesthesia of the areas supplied by the right trigeminal and glossopharyngeal nerves was maintained. The patient was comfortable and had been able to ingest food without pain.

SUMMARY

1. A new technic for the completion of glossopharyngeal nerve block is described.

2. Case reports are presented which illustrate the use of glossopharyngeal block in anesthetizing the base of the tongue for operative intervention and in providing an accurate diagnostic measure in the selection of patients for surgical section of the ninth cranial nerve.

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CONGENITAL CHONDROSTERNAL DEPRESSION (FUNNEL CHEST) RELIEVED BY CHONDROSTERNOPLASTY

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THE abnormality of the thorax, known commonly as funnel chest, pectus excavatum, trichterbrust, chone-chondrosternon, etc., is an oval depression of the chondrosternal area of the thorax. It is most often noted in early infancy and it becomes more marked as the child reaches maturity. The depth of the depression varies from a moderate depression of the sternoxiphoid angle to a severe depression in which the posterior surface of the sternoxiphoid angle is in contact with the vertebral column. In this report only the severe form is under consideration. It is brought to the attention of the physician because of its cosmetic and psychic effect or its interference with cardiorespiratory function. Due to this variance in degree a study of the incidence of the deformity may vary greatly with the investigator. In a review of the literature by Ochsner and DeBakey[9] twenty-eight cases were found in a total of 46,705 persons examined, an incidence of 0.059 per cent. It further disclosed that males predominate in the ratio of 4 to 1.

The etiology of this deformity has been attributed to various compressing forces such as pressure by the chin, knee or elbow during intrauterine life, obstructive conditions of the respiratory tract or rickets. Apparently heredity plays a conspicuous part as many case reports have shown entire families with varying degrees of the condition. In twelve families with 121 members Nowak[8] found forty-nine (40.4 per cent) affected with this deformity. J. Baunin,[1] in 1596, was the first to attribute the deformity to the pull of the diaphragm. In 1860 Woillez[12] stated that the retraction of the central diaphragmatic tendon was the most likely cause of the deformity. The operative findings of Brown,[2] Ochsner and DeBakey,[9] Sweet[11] and Lester[5] leave very little doubt that the deformity is produced by a congenital, short central tendon of the diaphragm. Brown believed that the disease was congenital and progressive. On the basis of this etiology he was the first to attempt to prevent the deformity by operative means in infants who manifest the early signs of chondrosternal depression.

A study of the various published papers reveals that there is a wide choice of names. All are descriptive of the outward appearance of the thorax but all have something lacking which inspires others to try another name. Funnel chest, pectus excavatum, trichterbrust and chone-chondrosternon may fit the deformity but do not explain the genesis of the disorder. Everyone describes it as an oval or funnel-shaped depression of the lower portion of the sternum and its adjacent cartilages. The weight of evidence now indicates that the condition begins with respiration at birth and results from a congenital developmental abnormality of the central anterior portion of the diaphragm. It is with a great deal of hesitation that the author wishes to suggest a new name for this condition. However, in its simplicity and description, the term congenital chondrosternal depression seems to fit more adequately. In addition it can be classified apart from the acquired type which may result from a traumatic injury or disease.

The pathology which has been adequately described consists, in the main, of the typical deformity of the anterior chest wall the compression or displacement of the heart in the majority of cases into the left hemithorax and the compression of the

lungs, both by the deformity and the paradoxical respiration. This paradoxical respiration is the result of the inward pulling action of the shortened tendon on its attachment to the sternoxiphoid junction. The shape of the chest conforms to the abnormal action of the diaphragm. The literature lacks an adequate description of the pathologic picture since there are no autopsy reports. Only the operative reports indicate a short central tendon and a dense contracted substernal ligament. Hutcheson[4] in a study of six patients in whom there was a definite displacement of the heart to the left, observed that even a marked displacement is compatible with good cardiac function and a complete absence of chest symptoms.

The clinical picture varies from no discomfort to symptoms of total invalidism. The vast majority suffer no ill effects from the deformity and lead normal full active lives. Many are never aware of the condition until it is brought to their attention at routine examination. Manning[6] reports a severe case of congenital chondrosternal depression in a twenty-six year old airman who was an athlete and boxer and had a vital capacity of 5,300 cc. A comparatively small proportion suffer symptoms of cardiorespiratory embarrassment because of the compression upon the heart and great vessels. Brown[2] is of the opinion that the greatest cardiac embarrassment appears to be present when the heart is fixed in the midline and is compressed by the sternum.

In young children there is usually no psychologic effect, but in adolescents and young women the deformity is often emotionally disturbing to the point of warranting cosmetic plastic repair. Symptoms seldom appear in children before the age of five at which time they usually begin the period of greater physical activity. The most common complaints are fatigue, dyspnea on exertion, palpitation and dull precordial pain. These children often avoid participating in the more active sports and tend to become shy, retiring and asthenic. Physical examination reveals the thoracic deformity, tachycardia and varying degrees of cyanosis on effort. The vital capacity is usually diminished, sometimes as much as 50 per cent. Electrocardiographic tracings in the majority of cases show no abnormality. Occasional cases show right axis deviation. On deep inspiration the lower anterior thorax retracts most markedly at the sternoxiphoid junction. Commonly a systolic murmur is heard over the mitral area so that many of these children are treated as cases of rheumatic heart disease.

According to Sweet[11] there are two cardinal indications for the surgical correction of this congenital deformity: (1) disturbance of cardiac function and (2) unfavorable effect on the emotional state of the patient. The success he had with surgical treatment in two sisters convinced him of the value of the procedure. It is Nissen's[7] opinion that operative treatment is indicated only when cardiorespiratory embarrassment is present.

Brown[2] describes two operative procedures in the treatment of congenital chondrosternal depression. The first is a comparatively simple operation in young infants who manifest the inspiratory retraction of the sternum and the early indications of the deformity. It consists of incision through the sternoxiphoid joint, bluntly separating the anterior diaphragmatic attachment from the substernal ligament. According to Brown this prophylactic procedure prevents the fixed bony depression which would result as the child grows older. The second procedure is reserved for the older group with the fixed bony depression who manifest cardiorespiratory distress. This consists in resecting bilaterally the deformed portions of the cartilages, transecting the sternum just below the manubrium, cutting across the substernal ligament and elevation and traction of the sternum.

The first prophylactic procedure was performed on two infants by Brown[2] and on three infants by Lester[5] with uniformly very satisfactory results. In the operative

FIG. 1. Congenital chondrosternal depression. Preoperative picture taken in inspiration with shoulders held back.

treatment of the older group Ochsner and DeBakey,[9] in their very exhaustive review of the literature, discuss the three types of operations that have been performed for the correction of this deformity in thirty-one patients since 1911 when L. Meyer performed the first operation. They report the best results have been obtained in eight patients with sternal mobilization and traction after bilateral costochondral resection. Garnier[3] first performed this type of operation in 1934. Ochsner and DeBakey[9] report a very satisfactory result in their own case. In addition, between 1939 and 1946, American literature contains satisfactory results by this method in three cases by Brown,[2] two cases by Sweet,[11] five cases by Lester[5] and one case by Phillips.[10] Nissen[7] reported satisfactory results in two patients after resection of the deformed portion of the sternum and suturing it horizontally to the costal cartilages in the reversed position.

The following case report is described to add another successful result by the operative procedure as modified by Brown:

CASE REPORT

C. R. age eleven years, a white female, was first examined in the Pediatric Clinic of Newark Beth Israel Hospital on October 9, 1939. Her mother stated that the child had been complaining of always being tired and upon the slightest exertion became faint. She did not play with other children or engage in any activity typical of her age group. She was referred to the cardiac clinic. On October 18th, when she came for an electrocardiograph, she appeared so ill that she was admitted to the hospital with a diagnosis of rheumatic heart disease.

Her father was living and well. He was of slight build with normal chest development. Her mother was living and well but had always been very much underweight. She was slightly round-shouldered and "flat-chested," but had no depression of the sternum. A younger sister of nine years was somewhat underweight but of normal development.

The patient's birth had been normal. She was breast fed for six weeks and then bottle fed. She appeared normally developed and began to walk and talk at the age of one. She had measles at the age of three, chicken pox at four, mumps at six and whooping cough at seven. She had a tonsillectomy at the age of three. Until February, 1939, according to the mother, she appeared in good health when she had a severe attack of "flu" and remained in bed for a whole month with high fever. From this time the mother stated that she noted her loss in weight and strength and the depression of the chest became more pronounced. Recently she had become nervous and complained of weakness and dyspnea on exertion. She also complained of precordial pain, frontal headaches and pains in muscles and joints of her legs.

Physical examination revealed the patient to be slender and bony. No dyspnea or cyanosis

were present. Her skin was pale, cool and moist. Her shoulders drooped forward and the chest was flattened. The sternum was depressed with the typical sharp angle at the junction of the gladiolus and the xiphoid. Breathing was abdominal in type and even on deep inspiration there was very little motion of the sternum. The depression measured 11 cm. long, 10 cm. wide and 5 cm. deep. The lungs were clear. The heart examination revealed a sinus arrhythmia and a systolic murmur over the apical area and at the base which was not transmitted. The point of maximum impulse was felt 3 cm. to the left of the nipple line in the fifth interspace. Blood pressure was 105/50. (Fig. 1.)

During her hospital stay the tuberculin test was negative. Venous pressure and circulation time were normal. Urine was negative and the blood count was normal except for a moderate secondary anemia. Roentgenograms showed displacement of the heart to the left and posteriorly. The heart appeared slightly enlarged with mitral configuration. Both central lung fields appeared congested with a slight degree of vascular accentuation. The asymmetry of the thoracic cage was noted with a considerable concavity of the lower three-fourths of the sternum causing a marked degree of narrowing of the ventrodorsal dimension of the thorax.

The electrocardiograph showed sinus arrhythmia, tachycardia, low voltage and right deviation of the electrical axis.

On October, 1939, the author in response to a consultation request, recommended a chondrosternoplastic operation to relieve the compression. This was not accepted because of the possible existence of rheumatic heart disease and the fact that surgical repair at this time was not well known. On November 6th the orthopedic service advised a special plaster jacket with a window over the sternal area in the hope that respiratory movements would correct the deformity. On November 16th a bilateral spica with arms in abduction was applied to the arms from the fingers to the chest and body down to the femoral trochanters. The patient was discharged on December 7, 1939, with the cast. The cast was worn for five months and removed in April but no improvement was noted.

The patient was readmitted to the Newark Beth Israel Hospital on June 10, 1940, for surgical treatment. At this admission a notation was made that the depression of the sternum was first noted when the child was about two years old and had steadily increased. Her chief complaints were precordial pain, dyspnea and faintness on exertion. The child showed no increase in growth but did gain about 10 pounds in weight since her first admission. She still appeared pale and undernourished. The patients vital capacity averaged 1,200 cc.

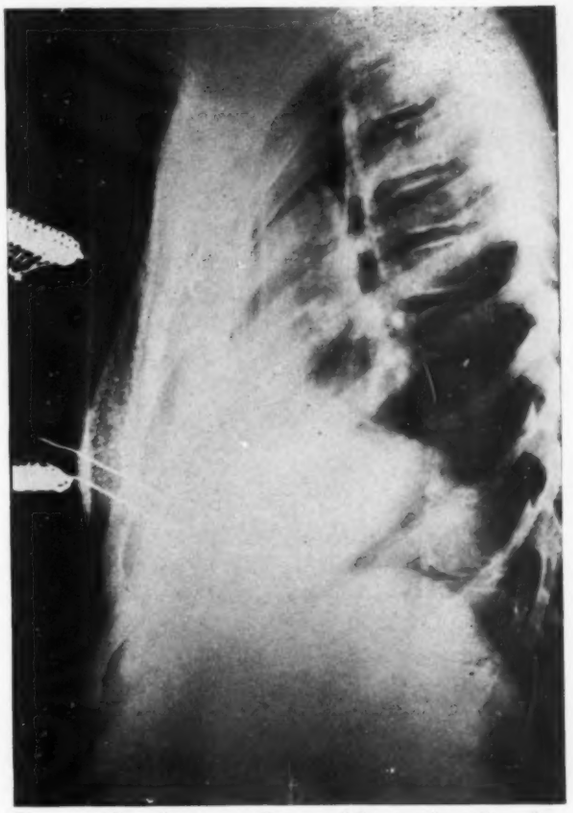

Fig. 2. Chondrosternoplasty with traction-elevation of sternum. Note silver wires at angle of Ludwig and lower end of gladiolus.

Operation was performed on June 11, 1940, under gas, oxygen, ether intratracheal anesthesia. A vertical mid-sternal incision from the angle of Ludwig to the end of the sternum was made. The skin and muscles were dissected off the costal cartilages on each side. Portions of depressed, angulated, costal cartilages were resected subperichondrially on each side from the second to the seventh costal cartilages. The xiphoid process was mobilized and removed. A narrow triangular wedge of the gladiolus of the sternum was removed transversely at the angle of Ludwig so that when the undersurface of the gladiolus was freed it could easily be elevated.

The dense fibrous tissue of the anterior mediastinum was incised transversely and the edges were seen to retract about 1 inch. The gladiolus was fixed in its new elevated position with two No. 20 silver wires. Another silver wire was taken in the lower end of the gladiolus and carried through the muscles and skin on each side 2 inches lateral to the incision. Muscle layers and fascia were sutured with interrupted No. 1 chromic sutures and the skin incision was sutured with interrupted silk. Flat rubber sponges were glued to the skin below the nipples on each side and a narrow curved wire bridge was placed across the lower chest with each end resting on the rubber sponges. The silver wire from the lower end of the sternum was tied on the wire bridge anchoring the raised sternum. Dressings were applied under the wire bridge covering the incision. The operation lasted two hours at the end of which time the condition of the patient remained good. At no time were the pleural cavities entered. (Fig. 2.)

The postoperative course was uneventful and the patient was discharged on the sixteenth postoperative day with the wire splint in place and the wound healed per primum. A shoulder brace was prescribed to correct the poor posture.

On discharge it was noted that the sternum was on a level with the rest of the anterior chest wall. The anteroposterior diameter of the chest was increased by 2 cm., now 14½ cm. Prior to operation the sternum was further depressed on inspiration but since operation it was elevated on inspiration. The heart murmur could no longer be heard. Very little change was noted in the electrocardiograms.

A follow-up interview about one year later revealed the fact that she indulged in normal activities, roller-skating and bicycling and joined in the play of her friends without any dyspnea or sensation of faintness. The symptomatic result was most satisfactory and a recent communication from the patient stated that she works steadily in a department store.

As far as the cosmetic correction of the deformity is concerned, the author agrees with Lester[5] that a 75 per cent correction should be considered a satisfactory result. An inverted Y-shape incision instead of a straight mid-sternal incision provides a wider exposure of the lower costal cartilages.

SUMMARY AND CONCLUSIONS

1. A case of congenital chondrosternal depression which was successfully corrected surgically by a chondrosternoplasty is presented.

2. A more appropriate name for this thoracic deformity is suggested, namely, congenital chondrosternal depression.

3. This congenital deformity may exist to a severe degree without knowledge of the patient or the presence of any untoward effect.

4. In a relatively small proportion there may be symptoms of cardiorespiratory embarrassment as well as severe and harmful psychologic effects.

5. To these patients surgery, by means of a chondrosternoplasty, offers complete relief of symptoms as well as improvement in the outward deformity. The operative procedure as advocated by Brown will prevent the bony deformity if it is applied in infants who are affected.

The author expresses his gratitude for the assistance of Dr. A. L. Brown in this case.

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GASTRIC RESECTION FOR DUODENAL ULCER

SURGICAL TREATMENT AND FOLLOW-UP STUDY

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WITH the last decade the pendulum has swung to a more radical method of treatment in chronic duodenal ulcers. It was the opinion of surgeons before this era that less radical measures were advisable. Since adapting gastric resection as the usual procedure for chronic duodenal ulcers, an attempt was made to analyze sixty-two consecutive patients who had resection done during the period from January, 1939 to January, 1943.

These patients were all male; thirty-six were veterans of World War I, twenty-two were merchant seamen and four were coast guardsmen, three of the latter already were retired on disability. Of this entire group only three were negroes. Their occupation in the seamen group ranged from captain, engineer and purser down to deckhand and mess boy. In the veteran group their occupations varied from salesman, janitor, carpenter, welder, delivery man, studio decorator, shipping clerk, dispatcher, fireman, chauffeur and laborer.

INCIDENCE OF GASTRIC RESECTIONS FOR DUODENAL ULCER

	No.	Per Cent
Resection for duodenal ulcer	62	56.4
Resection for gastric ulcer	30	27.3
Resection for carcinoma	16	14.5
Resection for gastric colic fistula	2	1.8
Total	110	100

Indications. The principles of management of malignant lesions are clear; the chief problem is early recognition. The common indications for operative intervention in duodenal ulcer, aside from perforation, pyloric obstruction and persistent bleeding, are chronicity and sufficient severity of symptoms which cannot be controlled by adequate medical treatment. Even then the results will depend to a large extent on the skill with which patients are selected for operation. In addition age, sex, occupation and personality of the patient must be taken into consideration since all of these factors influence results in any form of treatment. While intractability is the first essential, there are occasional cases in which operative procedure may be indicated early in the disease.

INDICATIONS IN THIS SERIES

	No. Cases
Resection for pyloric obstruction	9
Resection for intractability	31
Resection for bleeding	22

It is interesting to note that ten of these patients had been operated upon for perforations and in one instance the patient had two previous operations for perforation. In addition, six of the patients had been operated upon, before undergoing gastro-enterostomy, and a marginal ulcer was found at the time of gastric resection in two of these patients. Two patients were operated upon for acute hemorrhage.

DURATION OF SYMPTOMS

	No. Cases
2–3 years	15
5–10 years	20
10–15 years	13
15–20 years	14

AGE

	No. Cases
20–30 years	3
30–40 years	10
40–50 years	30
50–60 years	19

Gastric Analysis. Since the rationale of radical treatment in chronic duodenal ulcer is removing the most active portion of the stomach along with the acid-stimulating portion of the gastric mucosa and acid-secreting cells, special attention was given to preoperative gastric analysis. However, in reviewing these cases no record of preoperative gastric acidity could be found in twelve cases. Twenty-seven patients showed hyperacidity. Fasting stomach contents were used for the analysis before and after histamine. Gastric analysis was repeated between six months and a year postoperatively. In the twenty-seven cases listed as hyperacidity the records show a definite lowering of the acidity in twenty-two patients postoperatively. In one patient it remained the same. Of the six patients who complained of mild indigestion postoperatively, the free HCl and total acidity was low. No correlation or conclusion could be reached from this study in regard to gastric acidity. Low acidity was found in nine patients and normal acidity in fourteen.

Type of Resection. The Hofmeister modification of the Polya type of anastomosis was performed in all cases except five. The anastomosis was antecolic in all cases and the great majority were isoperistaltic. Fine chromic catgut was used as suture material, reinforcing the lesser and greater curvature angles with omental tags. Three layers of suture material were used. The Billroth two-type of operation was used in five patients. Four of these patients had a previous gastro-enterostomy with reactivation of the duodenal ulcer and bleeding in three cases. The lower part of the stomach was resected along with the ulcer after close inspection of the gastro-enterostomy stoma and stomach mucosa. The fifth subject had a large bleeding perforating ulcer into the head of the pancreas with marked inflammatory reaction which could not be resected. An exclusion type of operation was performed, resecting the lower stomach and ulcer at a second stage which was surprisingly easy to carry out. Partial resection (less than one-half) was carried out on twenty-four patients and subtotal resection (more than one-half) thirty-eight patients. The ulcer was not removed in two cases but the stomach and pylorus was resected with satisfactory results.

Physiology. In the case of duodenal ulcer we are dealing with a poorly understood derangement of normal physiology. Hyperacidity, tissue susceptibility, psychologic disorder and various other factors of temperament, environment and economics play a part. The rôle of antral hormone cells is also to be considered. One must also remember that these individuals have not been helped by other medical measures.

The chief gastric functions are digestive and motor. Disturbance in the latter function gives rise to symptoms in the great majority of gastric disorders. The motor function is amplified in the pyloric antrum and along the lesser curvature. For this reason lesions in these areas cause more symptoms. Physiologists have also shown us that there is a chemical stimulant present in the antral mucosal cells which excites gastric secretion and promotes motor activity. This property has not been demonstrated in the other mucosal cells; therefore, resection of the lower part of the stomach removes the most active part and the mucous membrane which produces an active hormone for acid secretion.

Technical Difficulties. Attention to details is important in subtotal gastric resection in order to prevent complications. The stomach is especially difficult to approach in heavy-set, stout individuals with large adipose deposits in the mesentery and omentum. It is also extremely vascular which occasions bleeding if careful attention is not paid to hemostasis. With reasonable care, hemorrhage can be controlled, the stomach resected and anastomosis performed satisfactorily. In doing this it is quite important to free the mesentery from the lesser curvature to allow proper closure

and prevent subsequent leakage. Technical difficulties may arise when making the anastomosis in extremely high resection for carcinoma or in handling the duodenal stump when resection is performed for duodenal ulcer. It is with the latter that we are particularly concerned in this discussion. Apparently nothing in the operation is more often responsible for failure than the improper closure of the duodenal stump.

Ulcers occurring in the duodenum, scar and distort that structure and, together with thickening of the wall, make closure of the stump extremely difficult at times. For this reason thorough visualization of the duodenum is practiced with partial mobilization to determine its mobility, relation of the common duct to the ulcer, and extent of involvement of the pancreas before beginning the resection. At this time a decision is made as to the method of handling the remaining duodenal stump. It is often surprising how much duodenal wall one has available for closure after mobilization by freeing the scar tissue. Even after this satisfactory closure depends upon how well one is able to free the posterior wall from its pancreatic attachments. With patience, good hemostasis and some persistence this step can usually be accomplished. In this series, when the duodenal stump was long enough, clamps were used in its removal and closure. When it was not long enough, it was left open, freed of its contents by suction, and closed with Connell catgut suture followed by carefully applied silk interrupted sutures.

Complications. Leakage of the duodenal stump was the main complication in this series and accounted for two deaths. Another patient with leakage from the duodenal stump which walled-off was treated by incision and drainage followed by constant suction by way of a well placed catheter in the wound. Postoperative hemorrhage was not encountered. The vessels in the stomach were tied with fine catgut at time of operation. Pulmonary complications were minor and credit is given to use of an oxygen tent along with CO_2 inhalations. Thrombophlebitis was not encountered. One patient developed a subphrenic abscess and parotitis along with hypoproteinemia. This individual had been operated on for acute massive hemorrhage. A large ulcer was found involving the head of the pancreas and extending down dangerously close to the ampulla. An exclusion type of operation was performed resecting the ulcer and duodenum later. This is the only case in the series in which a two-stage operation was performed. The subphrenic abscess was drained and the parotitis treated with x-ray. Shock was obviated by rendering adequate preoperative and postoperative care in regard to fluid balance as presented by the individual patient.

There were two patients with malfunctioning stoma who required jejunostomy. Their symptoms cleared up without further trouble within thirty days. Another patient had intestinal obstruction six months postoperatively.

Disruption of the wound did not occur in this series. This, at times, is a rather serious complication and may be just enough to cause death in a seriously ill patient. A high midline incision was used and the wound was closed with silk. The peritoneum was closed with fine No. 0 braided silk and the fascial structure with No. 000 braided silk. Interrupted sutures were used with properly spaced mattress sutures in the fascia in addition to the straight interrupted stitches. No retention sutures were used. Since this study, one hundred cases have been closed in this manner with only one partial disruption and postoperative hernia observed. We believe that the midline incision and closure with silk are the approach and procedure of choice, especially in resection for duodenal ulcer. Particular mention of the incision and closure is made because the results were much better than our previous experience with closure of high right rectus and high midline incision with catgut.

Mortality. In the resection for duodenal ulcer there were two deaths, both due to peritonitis from blow-out of the duodenal stump. In the entire series there were three deaths; one from an emergency operation for massive gastric hemorrhage. The fatality rate was 3.2 per cent.

POSTOPERATIVE COMPLICATIONS

	No. Cases	Results	Comment
Leakage from duodenal stump.	3	2 deaths	Incision and suction drainage with recovery in one case
Parotitis and hypoproteinemia.....	1	Recovered	Abscess drained
Malfunction of stoma.....	2	Recovered	Jejunostomy
Intestinal obstruction.	1	Recovered	6 months postopertive

Follow-up. Patients were studied for varying lengths of time as listed below:

No. Cases	Time Studied
14	6 months
13	1 year
16	2 years
9	3 years
10	4 years

Upon discharge from the hospital, patients were given careful, written instructions with regard to diet, use of tobacco and alcoholic beverages. In this entire group only ten patients stayed on a diet. Of these ten, six had mild indigestion occasionally. It is interesting to note that the large majority continue smoking, some to excess, and at least 50 per cent take an occasional drink with some listed as indulging in alcoholic liquors to excess. The six months' follow-up was recorded as good in fourteen patients. Of the others, thirty-four patients were following their regular occupations; twelve were doing less strenuous work and two were not working. Of the last two patients the result was good in one, the other had x-ray findings of gastrojejunal ulcer which was in accord with his symptoms. The other patient, complicated by gastrojejunal ulcer, returned two years postoperatively. This individual had been free of symptoms, smoked excessively and used alcoholic beverages to excess. He was working daily. His first symptom was weakness and in a few hours vomiting of a large quantity of blood. After this he began to have pain and the bleeding persisted. A high resection was done, removing the ulcer. He was followed postoperatively for one year and remained free of symptoms.

SUMMARY

1. A study of sixty-two cases of gastric resection for duodenal ulcer has been presented.

2. A follow-up study of these cases, with regard to gastric analysis and case fatality, is given.

3. Some facts as to technical difficulties encountered and evidence of complications in this series are presented.

4. There were two cases of gastrojejunal ulcer, following the resection in this group, representing an incidence of 3.2 per cent.

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Case Reports

HEMANGIOENDOTHELIOMA OF THE SALIVARY GLAND*

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HEMANGIOENDOTHELIOMA arising in the salivary glands is a rare condition. A case of such a tumor in a young infant is presented.

The most common lateral neck tumor in the young infant is a congenital cystic hygroma. Hemangioendothelioma in such a location is unusual. Smith[2] says, "A hemangioendothelioma of this region has never been observed at the Children's Hospital (Boston), nor has it been diagnosed prior to the present case in any of the 40,000 children born at the Boston Lying-in Hospital."

CASE REPORT

T. L., a male infant, was first seen on May 31, 1947, at the age of six weeks with no abnormalities noted. On June 20, 1947, the parents noted swelling of the left cheek. Three days later this was seen by a pediatrician who believed that the infant had a parotitis. A course of penicillin was given and the mass became somewhat smaller. It soon became large again and a course of sulfonamides was given with practically no effect. On July 14, 1947, the patient was seen in surgical consultation at which time the mass seemed to arise posterior and inferior to the left parotid gland, and the possible diagnosis of cystic hygroma was considered. The mass was followed for six weeks and grew steadily until it was about 8 cm. in diameter. It felt cystic and did not transilluminate light. The mass seemed to lie in the subcutaneous tissues of the neck. (Figs. 1 and 2.)

On August 19, 1947, an operation for removal of the tumor was performed by one of the authors (A. S. J.) under ether-oxygen endotracheal anesthesia. There was a large, wine-colored tumor about 6 by 5 by 4 cm. involving the left side of the neck from the transverse processes of the sixth cervical vertebra, the carotid and jugular vessels and the anterior surface of the sternocleidomastoid muscle to the skin. The tumor lay adjacent to the submaxillary and parotid glands but grossly seemed to be distinct from them. Many blood vessels extended from the tumor into surrounding tissues. Two lymph nodes were found in the area of the tumor. The tumor was excised intact. (Figs. 3 and 4.)

The postoperative course was uneventful, except for development of a partial, transient facial paralysis. (Fig. 5.)

The following pathologic report by Dr. Etheldred L. Schafer gives the gross and microscopic appearance of the specimen removed at surgery: "The gross specimen was a soft but not fluctuant, well encapsulated, dark red ovoid mass, measuring 5.5 by 4.5 by 3.5 cm. The external surface was faintly bosselated. The capsule was thin and transparent. Cut surfaces were coarsely lobulated, dark red, and slightly bulging. A small amount of blood exuded from the surface. Attached at one pole was a separate ovoid mass, measuring 1.5 cm. in maximum diameter, which had pinkish gray cut surfaces and resembled a lymph node.

"Numerous sections from the mass showed a vascular tumor involving salivary gland tissue. Some of the gland was visible at the margins of the tumor, and isolated glands and ducts occurred throughout the tumor. Delicate fibrous connective tissue septa divided the tumor into lobules reminiscent of the normal pattern of the salivary gland. In some regions, variable-sized blood-containing spaces with only thin walls separating them were numerous. These spaces were lined by endothelial cells which in some instances were plump. An

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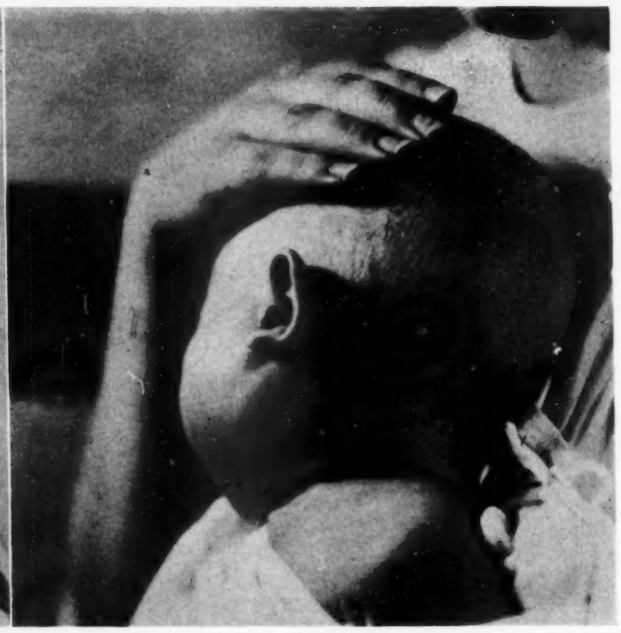

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FIGS. 1 and 2. Preoperative photographs of infant.

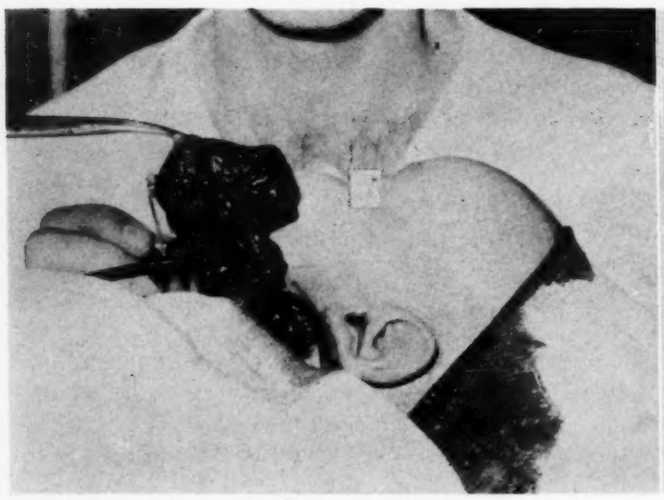

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FIG. 3. Tumor demonstrated at operation.

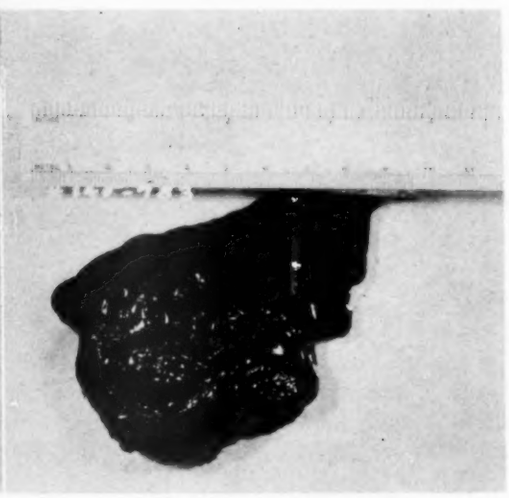

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FIG. 4. Specimen removed at operation.

occasional mitotic figure was noted among these cells. In other foci, compact masses of small cells occurred between the blood spaces. These cells had indistinct cell outlines. Their nuclei were round or irregularly oval and fairly uniform in size. The chromatin material was irregularly dispersed throughout the nucleus; none contained a nucleolus. Mitotic figures were more numerous in these compact foci, numbering as many as 4 to 5 per high power field. An occasional multinucleated cell was noted. The lymph node at the periphery of the tumor was normal. (Figs. 6 and 7.)

"The tumor belongs in that group of tumors known as angiomata, specifically to the hemangiomata. The following must be considered in making a diagnosis: hemangioma (capillary type), hemangioendothelioma, hemangiopericytoma, and hemangioendotheliosblastoma. The exact nature of the tumor cells and their relationship to blood vessels could not be demonstrated without special stains.

Fig. 5. Infant one month postoperatively.

Sections stained for reticulin by the Laidlaw method revealed anastomosing blood vessel channels with neoplastic cells largely confined within their reticulin sheaths. Thus, they are neoplastic endothelial cells, and the tumor is considered a hemangioendothelioma. Stout[1] who saw the sections and made the Laidlaw stains concurred in this diagnosis. Several other pathologists who viewed the sections variously diagnosed the tumor as a simple hemangioma or a hemangioendothelioma. The extreme cellularity of the tumor, the mitotic figures, and the multinucleated forms within the neoplastic cells remove this tumor from the group of simple capillary hemangioma. The presence of mitoses is thought to be consistent with a period of rapid growth of the tumor in an infant and not to indicate a malignant neoplasm.

"The diagnosis is a hemangioendothelioma arising in the salivary gland."

Lateral tumors of the neck are diagnostic and therapeutic problems met occasionally by head and neck surgeons. Along with cystic hygroma, other conditions to be considered in the young infant are infectious parotitis, tuberculous adenitis, acute

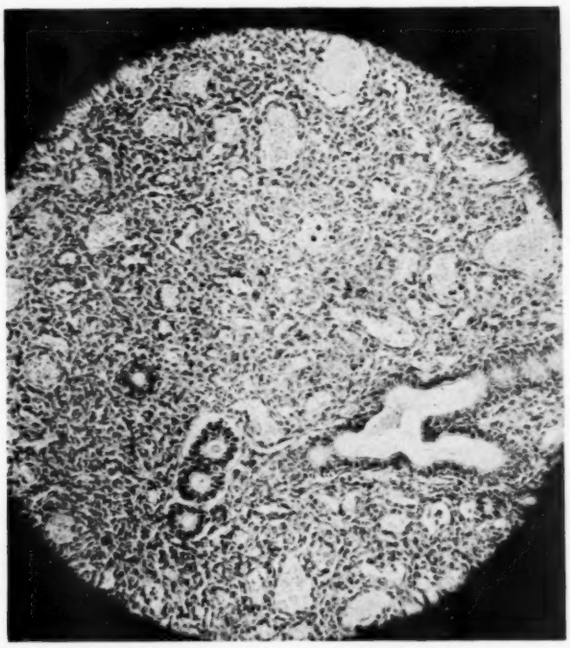

Fig. 6. Photomicrograph of a portion of the tumor to show presence of salivary gland ducts. Note the irregularly shaped blood-containing spaces separated by masses of neoplastic cells (× 150).

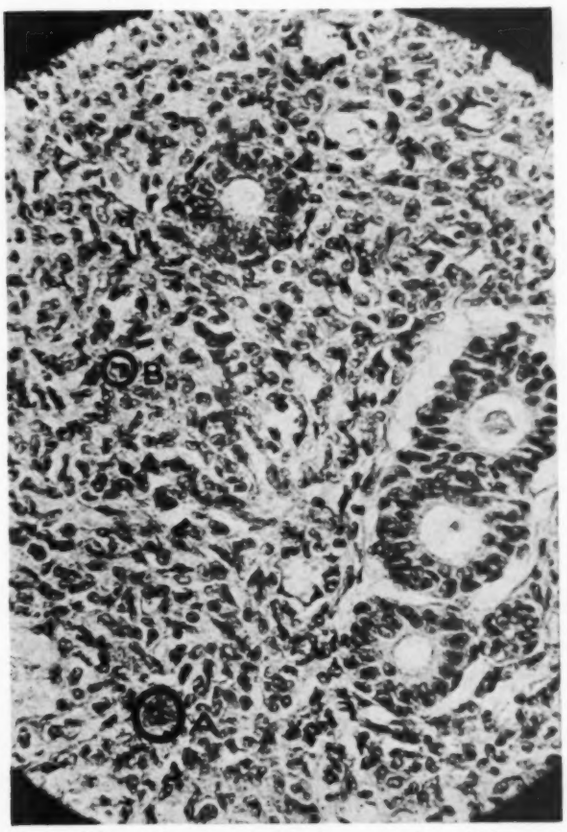

Fig. 7. Photomicrograph showing a portion of Figure 6 under higher magnification. Details of the neoplastic cells are more clearly shown. Note the multinucleated cell at A and the mitotic figure at B (× 450).

leukemia and branchiogenic cysts which rarely occur at this age.

In a review of American literature from 1916 no mention of this type of tumor arising in the salivary glands was found. Other tumors in this region are also rare. The sections from this case have been reviewed by a number of pathologists, all of whom concurred in the opinion that this was a benign vascular tumor; however, it was variously designated as a hemangioma (simple type) and a hemangioendothelioma. Three of the above pathologists mentioned had seen similar tumors, apparently primary, in a salivary gland. No reports have appeared in the literature.

Reading on this subject is difficult because the criteria for the classification of blood vessel tumors has not been clearly defined. Each author who has written on the subject has his own classification and terminology. Ewing,[3] Geschickter, Watson and McCarthy[4] and Stout[5] are among those who have classified these tumors.

From a surgeon's standpoint the pathologic interpretation of the tumor is important primarily from a prognostic aspect. Diagnosis in this case rests upon specific criteria set up by Stout[5] which are: "No tumor should be considered an hemangioendothelioma unless the following two features are present: first, the formation of atypical, endothelial cells in greater numbers than are required to line the vessels with a simple endothelial membrane; and, secondly, the formation of vascular tubes with a delicate framework of reticulin fibers and a marked tendency for their lumens to anastomose." Stout considers this a malignant tumor except in infants when it is usually benign.

Hemangioendotheliomas in the neck of infants have been reported by Smith,[2] Watson and McCarthy[4] and Sweitzer and Winer.[6] None of the three cases reported arose in salivary tissue. The tumors in the case reports of Watson and McCarthy and of Sweitzer and Winer were cutaneous and red.

SUMMARY

A case of benign hemangioendothelioma of the salivary glands is presented with a discussion of the gross and microscopic features involved and the possible benignancy of the tumor. A critical review of the literature reveals that these tumors are relatively infrequent.

The authors wish to express their appreciation for the assistance of Dr. Ethelred L. Schafer, pathologist of the Jackson Clinic.

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STENOSIS OF THE INTESTINE AFTER STRANGULATED HERNIA*

WITH FATAL COMPLICATION FOLLOWING INTESTINAL INTUBATION

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STENOSIS of the intestine following the reduction of a strangulated hernia is relatively uncommon. The first authentic record of such a complication is the case reported by Guignard in 1864. Cotte and Leriche, in 1905, collected thirty-nine cases and more recently Costa, Barry and Raw have added to the literature several instances of this sequela of strangulation.

We have recently observed at the Lahey Clinic two cases of delayed stricture and one of potential stenosis of the small intestine secondary to strangulated hernias. One patient presented, in addition, an unusual and fatal complication of intestinal intubation.

CASE REPORTS

CASE 1. A woman, fifty-two years of age, was first seen in the clinic on April 9, 1945, complaining of abdominal cramps and distention of two and one-half years' duration. In October, 1942, she had a strangulated femoral hernia repaired without resection of the involved intestine. The immediate postoperative course was characterized by diarrhea and abdominal cramps. Following discharge from the hospital, she had recurrent attacks of colicky pain which varied in frequency from once a week to once a month. The pain was accompanied by distention of the abdomen and anorexia. The weight loss was gradual. In February, 1945, she had several severe attacks during which vomiting was extreme.

Examination revealed that the patient was poorly nourished and chronically ill. Numerous loops of thickened, dilated intestine could be seen and felt through the thin anterior abdominal wall. Peristalsis was active.

Serial films of the small intestine after a barium meal showed several loops of moderately and greatly distended small bowel. The degree of dilatation was greatest in the lower ileum. Diagnosis was made of obstruction of the small bowel. Attempts to decompress the bowel with the Miller-Abbott tube were not successful and operation was advised.

The abdomen was opened on May 22, 1945. Numerous loops of dilated, thickened small bowel were encountered, extending from the upper jejunum to the lower ileum. Approximately 45 cm. (18 inches) proximal to the ileocecal valve there was an annular constriction of the intestine measuring about 2.5 cm. in length. The bowel was considerably scarred at this point. Below this stenotic area the intestine was collapsed. The proximal distended bowel was decompressed by gradually advancing the Miller-Abbott tube along the lumen of the intestine while continuous suction was exerted from above. An entero-enterostomy was performed by-passing the area of constriction.

Following operation, the temperature rose gradually and then assumed spiking, septic proportions. Abdominal distention did not subside. On the second postoperative day a sausage-shaped mass was palpable to the left of the incision. A moderate amount of blood drained through the Miller-Abbott tube but intestinal decompression was not accomplished. Despite vigorous supportive measures the patient failed to respond and died on the ninth postoperative day.

At autopsy the peritoneal cavity contained 2,000 cc. of foul-smelling fluid and considerable gas. The loops of intestine were matted together and greatly distended. Approximately 50 cm. distal to the ligament of Treitz there was a perforation of the jejunum. Just below the point of perforation 30 cm. of bowel was intussuscepted into a 10 cm. segment of intestine. Twenty cm. distal to this involvement there was another firm mass which represented

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another area of intussusception. The entero-enterostomy in the terminal ileum was intact and widely patent.

Case II. A woman, sixty-six years of age, was examined in the clinic on February 26, 1946. She complained of recurrent bouts of abdominal colic, associated with nausea and vomiting. Constipation which had been chronic for years, had become progressively worse.

In June, 1945, a strangulated hernia in the right inguinal area was repaired surgically without intestinal resection. The patient had considerable nausea and vomiting attended by crampy abdominal distress immediately after operation. These symptoms persisted and led to a second operation in September, 1945, ostensibly for the release of intra-abdominal adhesions. This procedure was followed by recurrent episodes of nausea, vomiting and abdominal pain. Gurgling abdominal noises and palpable abdominal masses had been noted by the patient. She had lost 34 pounds.

Physical examination revealed that the patient was thin and emaciated; she weighed 98 pounds. There was some mild arthritic deformity of the fingers. The heart was slightly enlarged but the sounds were clear. The abdominal wall was soft and flabby and large loops of hypertrophied small bowel were palpable throughout the abdomen. There were two well healed scars in the right lower quadrant of the abdomen. Diagnosis was made of small bowel obstruction, secondary to a contraction ring in an area of previous strangulation.

Following adequate decompression of the bowel with the aid of the Miller-Abbott tube, laparotomy was performed on February 28, 1946. The abdomen was entered through a low, right rectus incision. The proximal portion of the small intestine was dilated and the wall was thickened and edematous. There was an area of fibrosis and stenosis in the mid-ileum which almost occluded the lumen of the bowel. The strictured area measured about 5 cm. (2 inches) in length and was characterized by a densely scarred ring surrounding the bowel at each extremity of the area of narrowing. An entero-enterostomy was made so as to by-pass the stricture. The abdomen was closed in layers.

The postoperative course was uneventful and the patient was discharged from the hospital on the thirteenth day following operation. One month later she was entirely well and had gained 28 pounds.

Case III. A man, sixty-two years of age, came to the clinic on March 22, 1946, complaining of pain in the abdomen of six months' duration. Two years before this visit he had had an operation elsewhere for recurrent pain in the right upper quadrant of the abdomen. He did not know what was found or what procedure was performed. He was well for eighteen months following operation, but then abdominal colic, increasing constipation and weight loss recurred. Upon two occasions during the six weeks before his examination at the clinic he had vomited a large amount of greenish fluid approximately six hours after eating.

The patient was extremely obese, with flabby musculature. The abdomen was pendulous and soft. There was mild tenderness in the region of the scar in the right upper quadrant of the abdomen where a defect was palpable, permitting protrusion of viscera upon coughing.

Routine laboratory data were normal. Cholecystograms revealed no gallbladder shadow. Barium studies of the stomach, duodenum and colon were negative.

He was placed on a reduction diet and bowel management which relieved his distress temporarily.

On September 16, 1946, following a large meal containing much roughage, the patient had severe abdominal pain, vomiting and obstipation. On examination a tense, tender, irreducible mass was found in the lower angle of the upper abdominal scar. He suddenly collapsed while in transit from one department of the clinic to another but revived spontaneously without residual symptoms. Diagnosis was made of strangulated hernia and operation was undertaken immediately. The sac was exposed and opened. A loop of small bowel about 20 cm. in length was liberated. It was a dusky purplish color with plastic exudate on the surface. One end of the confined loop was firmly adherent to the margin of the defect in the abdominal wall and the bowel at this point was narrowed and deeply creased. The color of the intestine returned to normal but the deep furrow did not relax. Consequently, a lateral entero-enterostomy was fashioned in order to circumvent the area of potential stricture. The hernial defect was repaired.

Recovery was devoid of incident and the patient was discharged from the hospital on the eleventh postoperative day. He has had no recurrence of abdominal distress.

COMMENTS

Pathology. Alterations in the bowel wall following strangulation vary from transient edema to gangrenous necrosis and perforation. Recovery of the involved intestine may be complete or partial. The mucosa is most seriously affected by strangulation and it may suffer from venous congestion, thrombosis and necrosis. The other coats of the intestine will be damaged, but to a lesser degree. Healing results in scarring if thrombosis and necrosis are marked.

The factors which determine the extent of damage to the bowel wall, as pointed out by Barry, are: (1) duration of strangulation, (2) tightness of the neck of the constricting sac and (3) resiliency of the vascular tree.

The stricture may be "physiologic" and transient because of interference with intestinal motility as a result of disturbance in the neuromuscular mechanism. Organic stricture, on the other hand, develops more gradually and persists until relieved by surgical measures. Organic stenosis may be annular or tubular in character. The former tends to involve a small segment of the bowel at either or both extremities of the constricted loop. Tubular involvement is longer and apparently results from impairment of the blood supply to the entire loop of strangulated bowel.

The most common location of these strictures is in the ileum. None have been reported in the large bowel. The intestine above the area of obstruction is dilated and thickened while that below the stenosis is deflated, thin and atrophied.

Delayed stenosis is more common following strangulated inguinal hernia than following femoral hernia although strangulation is more frequent in the latter type. Of thirty-seven cases collected by Jaboulay and Patel, twenty-seven patients had inguinal, eight femoral and two umbilical hernias.

Symptoms. Symptoms may occur immediately after successful taxis or operative reduction of a strangulated hernia. The most common history is one of immediate postoperative obstruction which subsides for a few days or weeks and then recurs in the form of subacute or chronic obstruction. Recurrent colicky pain, nausea, vomiting, loss of weight and anemia constitute the classical clinical features. The immediate postoperative period is frequently characterized by an episode of bloody diarrhea which may indicate necrosis of the mucous membrane at the site of strangulation.

Physical signs include wasting, abdominal distention, palpable loops of distended, hypertrophied bowel and ausculatory evidence of excessive peristaltic activity. Serial films of the small bowel may or may not demonstrate slowing of the intestinal stream or narrowing of the lumen of the bowel.

Diagnosis should be made with reasonable accuracy in an individual with a past history of a strangulated hernia in whom the immediate postoperative course was marked by bloody diarrhea, associated with obstructive phenomena which subsided temporarily, only to recur in a more persistent fashion.

Treatment. Operative treatment is indicated and should be resorted to without undue delay. Simple plastic procedures on the constricted area of the bowel are as difficult as, and usually less effective than, a short-circuiting entero-enterostomy or resection. We believe that entero-enterostomy is the treatment of choice in this type of benign localized obstruction.

Decision to perform an entero-enterostomy at the time of the initial operation for relief of a strangulated hernia to obviate a future stenosis is a matter of surgical judgment which must be decided upon the merits of each individual patient. Watson stated that the constricted area should relax when this portion of the bowel is

stroked gently with a moist pledget of cotton. If the groove persists, it signifies a reasonable prospect of future stenosis and should be treated accordingly. It is, of course, the essence of wisdom to remember at all times that the primary purpose of emergency surgical intervention is to save the patient's life and that considerations of definitive cure are not to take precedence over this primary concern.

Serious complications of intestinal intubation, directly referable to the tube, are rare. Smith, in an analysis of 1,000 cases involving the use of the Miller-Abbott tube, listed eleven instances of serious sequelae, including hemorrhage, ulceration and perforation of the bowel. Iglaeur and Molt reported several instances of laryngeal edema requiring tracheotomy. Knotting of the tube, overdistention of the balloon and many minor complications have been observed in the use of the Miller-Abbott tube. Intussusception of a sufficient degree to cause obstruction of the bowel, such as occurred in one case reported herein, is a rare complication of intestinal intubation. A similar example has not been found in the literature. Presence of this complication was not appreciated in this instance, and a fatality resulted.

CONCLUSIONS

Stricture of the small intestine may occur following reduction of a strangulated hernia.

Future stenosis may be anticipated and prevented at the time of the original operation in some instances.

Intussusception of the small intestine over an indwelling Miller-Abbott tube may occur and result in complete intestinal obstruction.

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MULTIPLE DIVERTICULA OF THE JEJUNUM

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DIVERTICULA of the jejunum constitute the rarest type of diverticulum which occurs in the gastrointestinal tract. It is exceedingly rare in comparison with diverticulosis of the duodenum and the colon. This condition was first described by Sir Astley Cooper in 1844 when he found numerous pouches of the jejunum in a postmortem examination upon a man of sixty-five. In 1881 Dr. Osler, in a postmortem examination upon a man of fifty-five, reported diverticula varying in size from a cherry to a large apple. Many other men have described this condition. Hansemann found 400 diverticula in a man of eighty-five at a postmortem examination. Dr. Harold C. Edwards, King's College Hospital, London, in a book published in 1939 gives the most extensive and interesting descriptions of various diverticula of the small and large bowel, and he states that he studied sixteen cases of diverticula of the jejunum, eight of which were from postmortem examinations, four from operations and four from x-ray records. Rankin and Martin in 1934 and Chapman in 1933 and 1934 contributed excellent papers to this subject. Sheppard collected sixty-one cases up to 1935. Levy and DeGroat collected sixty-six cases up to 1935. Rosedale and Lawrence collected seventy-eight cases up to 1936 and reported three cases in 5,000 postmortem examinations. Goddard reported sixteen diverticula of the small intestine (other than Meckel's diverticula) in 13,069 autopsies. Up to 1938 Gerstler found 187 cases in the literature. Since then Ravenswaay increased the number of cases to 228. From a roentgenologic standpoint no accurate figure is possible because they are so easily missed. Rosedale and Lawrence did not find a single example in 5,000 complete gastrointestinal examinations. Rankin and Martin state that jejunal diverticulosis is found once in 25,000 x-ray examinations. Spriggs and Marxer found thirteen cases in 1,000 radiographs. Johns in 1937 said only twenty-six cases had been discovered by x-ray and only seventeen of these were confirmed by operation. Weber states that if the roentgenologist is given the opportunity, he can diagnose the condition by roentgenoscopic and roentgenographic examination if characteristic roentgenograms are produced.

Benson, Dixon and Waugh in 1943 made the statement that such diverticula are not exceedingly rare. They stated that the Mayo Clinic, from 1909 to 1942, observed diverticula of the small intestine in 122 cases. These 122 cases included the fifty-two cases that were reported in 1934 by Rankin and Martin. In addition to the 122 cases reported by the above observers, approximately 200 other cases are recorded in the literature.

The records of the Maryland General Hospital, Bon Secours Hospital and South Baltimore General Hospital were searched for the history of a case with multiple diverticula of the jejunum, both in the hospital and x-ray departments, but none was found. The records of the University of Maryland Hospital were reviewed and it was found that one patient, aged seventy-six years, was admitted and found to have two dozen diverticula of the jejunum. Another patient, aged forty-five, who was admitted on the medical service, was found to have several small diverticula of the jejunum. No operative procedure was performed. The patient's symptoms were epigastric distress, fullness following meals and a smothering sensation. The patient complained of gaseous distention for the past two years, some nausea and the desire to vomit.

1 2

Fig. 1. A white male, aged eighty-one, a case of Dr. Charles Waters, showing large diverticula of the jejunum. No operation was performed. The patient died several years later from other causes.
Fig. 2. A white female, aged seventy-eight, a patient of Dr. Charles Waters, with multiple diverticula of the jejunum; no operation was performed and the patient is still living.

Dr. Charles Waters, a radiologist in Baltimore, had two patients in his experience who had multiple diverticula of the jejunum but no operation was performed. (Figs. 1 and 2.)

Most diverticula of the small intestine are of the mucous membrane, hernia type. Practically all are of the acquired type. The site of herniation of the mucous membrane through the wall of the intestine occurs at the area where the blood vessels perforate the muscular coat of the intestine. Most observers believe that two factors are present: (1) a weak area in the bowel wall and (2) a pulsion force acting from within the bowel which starts the process of herniation. The protrusion occurs where the blood vessels perforate the muscular coat of the intestine. There are some observers, however, who believe that they may be congenital in origin. Of the 122 cases in the Mayo series, 100 cases occurred in the jejunum. In seventeen of their cases the diverticula were limited to the ileum, and in five cases the diverticula occurred throughout the small intestine. While these diverticula may occur in any part of the circumference of the bowel, a majority of them are situated either within the leaves of the mesentery or along the mesenteric attachment. The diverticula of the jejunum are much larger than the usual tiny diverticula seen in the colon. The mouths of these diverticula may vary from 2 or 3 mm. to 3 or 4 cm. in diameter. In forty-four of the 122 cases reported by Benson, Dixon and Waugh only one diverticulum was observed. In sixty-six cases three or more were present. Diverticula in other viscera were observed in forty-nine of eighty-five cases in which autopsy was performed. In these reports they state that these diverticula are noted in all age groups, seven cases being found under ten years of age. The youngest in their present series of cases was twelve years old. The oldest was ninety-one. At the Mayo Clinic most of the diverticula of the small intestine

have been found at autopsy—(eighty-five cases). Twenty-one cases were recognized during the course of abdominal operations. They state that these diverticula are not easily identified at the operating table because they offer so little resistance to the palpating hand that they may escape identification, and often they are hidden within the leaves of the mesentery. In sixteen of the 122 cases the diverticula were found on x-ray examination of the small intestine.

The symptoms of chronic intestinal obstruction may be associated with diverticulosis of the small intestine. This was the most commonly observed complication in most of the cases reported. The more marked symptoms are (1) vague pain or abdominal discomfort and (2) flatulence. The flatulence is due to retention of intestinal contents in the diverticula. The pain may be due to the same cause or, if pain is particularly severe and colicky in nature, it may be due to obstruction in the bowel by a large pouch. Other complications such as acute obstruction, inflammatory disturbances resulting in gangrene and perforation, hemorrhage from the diverticula, rupture of the diverticula, foreign bodies and neoplastic diseases may be encountered.

Treatment. If the patient is asymptomatic and there are no complications, surgery is not required. These people may be carried along satisfactorily by proper control of their bowels and limitation of intake of foods rich in starch and cellulose. When the diverticula are of large size and x-rays show a long retention of barium and when the patient has symptoms of chronic intestinal obstruction, the treatment should be surgical and the proper surgical procedure should be resection. The resection can be done either by end-to-end anastomosis or by lateral anastomosis.

CASE REPORT

An interesting case of multiple diverticula of the jejunum came under our care:

A white female, aged sixty-three, entered the Maryland General Hospital on January 5, 1943. She complained of generalized abdominal pain and marked distention. The past history showed that the patient had had her gallbladder and appendix removed in this same hospital by another surgeon fourteen years before. At that time she had pain in the upper abdomen with jaundice and the gallbladder contained many stones. No mention was made in the operative note at that time of any pathological condition involving the jejunum. In 1938, four years prior to admission, the patient had had a Mayo hysterectomy performed in another hospital where a diagnosis of prolapse of the uterus, cystocele and rectocele had been made. The patient dated her present illness to three years prior to admission when she began to have cramp-like pains over the entire abdominal area. These attacks of pain bore no relation to the ingestion of food although the patient said she felt better when she remained on a vegetable diet. She stated that she had twelve to fifteen semi-solid stools per day but noticed no blood or mucus. She had had no jaundice since 1929. In the last few months the abdominal pain had been more severe in character and there had been an accumulation of gas in the intestines which was difficult to relieve. Three years before she weighed 190 pounds and since then had lost 62 pounds. In the last few weeks she had had difficulty in moving her bowels. She had had some belching and nausea associated with attacks of vomiting.

Physical examination on admission revealed a sixty-three year old, white female, showing evidence of recent loss of weight, at this time weighing 128 pounds. The abdomen showed a well healed upper right rectus scar with no hernia present. The muscle tone of the abdominal wall was poor. Many loops of distended bowel could be seen and easily palpated through the abdominal wall. No masses were palpable. The liver was not enlarged. There was no fluid in the abdomen. Pelvic examination showed a good perineal floor. The uterus and adnexa were absent or at least could not be palpated. The blood pressure was 180/90. No evidence of cardiac disease was present. Rectal examination, both digitally and by proctoscopic examination, revealed no lesion in the lower bowel.

X-ray examinations of the chest, both fluoroscopic and with films, showed the lung

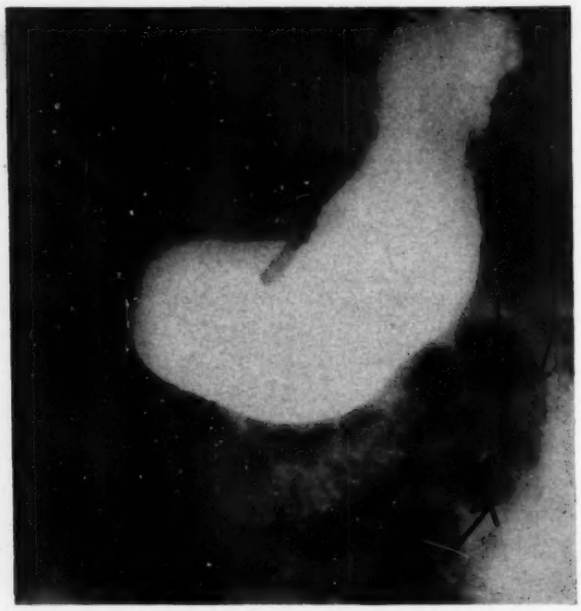

Fig. 3. Mrs. E. H., radiograph showing position of diverticula in jejunum below the stomach and transverse colon.

fields to be clear with normal root and bronchial markings. The heart measured 12¼ cm. across its greatest transverse diameter with an internal diameter of the chest of 26 cm. A barium enema showed that the bowel filled without difficulty but was somewhat redundant. (Fig. 3.) Two or three fair-sized diverticula were found in the sigmoid area. There was no filling defect to suggest malignant growth. The stomach was reported to be slightly taut and pulled to the right side. It was atonic but no defect was found in the stomach, the prepyloric area or the duodenum. No evidence of new growth was found nor was there evidence of any pathological condition in the small or large bowel.

The blood chemistry, urinalysis, stool examination and blood studies showed no abnormality. The Wassermann test was negative. A tentative diagnosis of intestinal obstruction involving the small bowel was made. From the symptoms and signs it was believed that the obstruction was of a chronic nature and had periods in which the patient was much better and at other times much worse. Because of great loss of weight, and the more marked symptoms that the patient had in recent weeks, it was believed that abdominal exploration was indicated.

Under spinal anesthesia an upper midline incision was made. All of the abdominal organs were found to be normal except the jejunum and the descending colon. There were a few diverticula in the large bowel. The jejunum was found to be markedly distended and hypertrophied, being twice the normal diameter. Beginning about 6 inches below the ligament of Treitz, there were multiple diverticula along the mesenteric side of the bowel, varying in size from a marble to a small orange. These diverticula extended for a distance of 3½ feet.

Fig. 4. Specimen removed at operation showing multiple diverticula.

There was no definite demonstrable mechanical obstruction of any portion of the jejunum. Some of the diverticula were very large and seemed to compress the bowel, but when squeezed, the gas passed readily into the intestine. In view of the patient's history of marked weight loss and her other symptoms and since this was the only pathological condition found, it was deemed advisable to resect this entire portion of jejunum. (Fig. 4.) Therefore, about 3½ feet of jejunum were removed between Payr clamps. The ends of the bowel were closed and inverted. The proximal portion of jejunum was anastomosed to the distal portion of jejunum by lateral anastomosis with rubber-covered intestinal clamps. The abdomen was closed and the patient returned to bed in excellent condition.

The specimen removed consisted of a section of jejunum well over a meter in length which, by actual count, contained fifty-nine diverticula. These diverticula varied in size from a medium-sized marble to a small orange and were situated at or near the mesenteric border of the intestine.

Gross Diagnosis: Multiple diverticula of the jejunum.

Microscopic examination showed the walls of the bowel to be somewhat hypertrophied, but the diverticula contained thinned-out muscle fibers with nothing but serosa and a thin layer of mucosa. (Fig. 5.)

After operation, when reporting to the roentgenologist of what was found, we reviewed the x-ray plates and then saw diverticula of the jejunum which we had missed originally.

The patient made an uneventful recovery and was discharged three weeks after operation. While in the hospital, she gained 5 pounds in weight. The patient has been seen several times during a period of three and one-half years. One month before the preparation of this report she was in excellent health and weighed 170 pounds. She had had no digestive disturbances and no stool abnormalities since operation three years and ten months before.

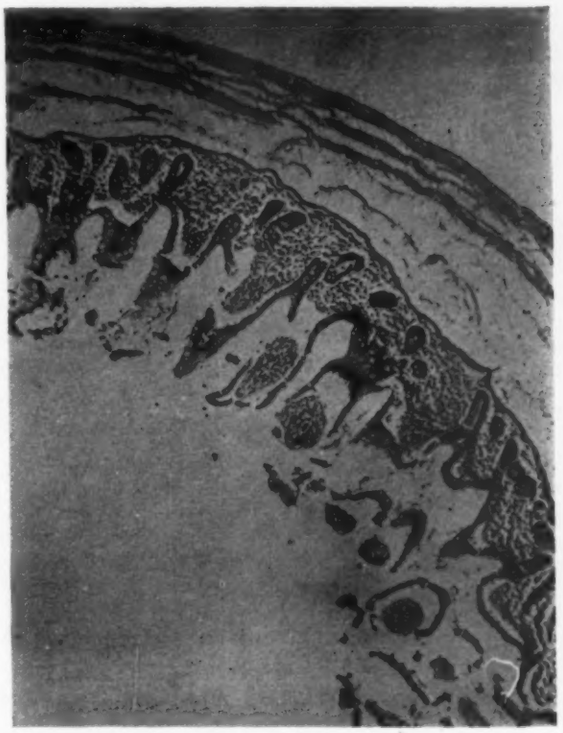

Fig. 5. Microscopic appearance of the wall of one of the diverticula showing thinned out muscle fibers with a thin layer of mucosa and serosa.

SUMMARY

As far as I am able to determine by existing records, 322 cases of jejunal diverticula have been reported previously in the literature. A great majority of these cases were reported as result of autopsy findings or x-ray examinations of patients with the condition. A new case, that of a sixty-three year old female who was successfully operated upon, is added to this list. The condition can and should be diagnosed by x-ray findings. There are many cases which give rise to no symptoms, but those patients who produce symptoms of obstruction or other complications should be operated upon for relief. The best type of operation is resection.

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In some cases of pyloric obstruction *all* tests, including x-rays, gastroscopy, etc., fail to establish firmly the correct diagnosis, according to Segal et al. The authors state that they have used sodium amytal often with success in trying to differentiate pyloric obstruction due to intrinsic causes (ulcer, fibrosis, carcinoma, etc.) from persistent pylorospasm of psychogenic origin. (*Richard A. Leonardo, M.D.*)

PREGNANCY COMPLICATED BY TRANSMESENTERIC HERNIA

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THE association of pregnancy and acute intestinal obstruction from any cause is fortunately a rare occurrence. A number of references to this combination can be found in the German literature in contrast to the few references to the topic in the English.

A series of cases have been collected by Ludwig,[3] von-Mikulicz-Radecki[7] and Eliason and Erb.[2] The prime causes of obstruction are seen to be adhesions, volvulus and the pregnancy itself where the simple enlargement of the uterus produces mechanical obstruction of the bowel by external pressure. (Table 1.)

TABLE 1
STATISTICAL SUMMATION OF THREE SERIES OF PREGNANCIES COMPLICATED BY INTESTINAL OBSTRUCTION

	Ludwig	von Mikulicz-Radecki	Eliason and Erb	Total
Adhesions	28	15	14	57
Volvulus	13	34	11	58
Pregnancy Certain	10	10	28	48
Uncertain	0	8	0	8
Kink in the arteries of the mesentery	1	0	0	1
Tumors and cysts	25	4	7	36
Obturation	7	0	0	7
Intussusception	4	3	0	7
Hernia	7	1	2	10
Paralytic inflammatory	0	0	4	4
Unknown	0	6	0	6
	95	81	66	242

A study of the maternal mortality in these three series of cases is interesting as it reflects the progress of surgery during these periods. In the patients of Ludwig, end results were known in eight-nine cases. Forty-nine patients died, giving a total mortality of 55 per cent. Von Mikulicz-Radecki was able to determine the end results in seventy-one of his collected cases. Twenty-eight patients died, resulting in a mortality of 39.4 per cent. In their sixty-six patients, Eliason and Erb report fourteen deaths and a mortality of 21 per cent.

The patient, whose case history will be detailed later, had a transmesenteric or internal hernia. Intra-abdominal hernias producing acute intestinal obstruction are unusual entities. Only seven internal hernia were found in an analysis of 136 cases of acute intestinal obstruction encountered at the Mayo Clinic from 1935 to 1939, inclusive, by Mayo, Stalker and the author.[4] A review of all types of internal or intra-abdominal hernias at the same clinic reported by the same authors[5] revealed that only thirty-nine such cases were encountered in the years 1910 to 1939 inclusive.

These hernias protrude into an abdominal pouch or opening of the peritoneum or through an aperture in one of the several mesenteries, in contrast to external hernias in which abdominal contents pass through defects in the wall of the abdomen. An internal hernia may be primary, a direct result of some congenital defect or secondary to operation, trauma or or inflammation. Thus, they include: (1) Those which occur in normal pockets such as the foramen of Winslow and the paraduodenal, paracecal and intersigmoid fossa; (2) those occurring in exaggerations of normal mesenteric folds as those in the broad ligament of the uterus; (3) those resulting from traumatic or operative bands or adhesions; (4) those resulting from chronic inflammation and (5) those which occur in anatomic defects.

Internal hernias due to defects in the normal mesenteries, inadvertently created by the surgeon, are infrequently seen now owing to the proper observance of technic at the time of performance of an operative procedure. Therefore, the more important group at present are the internal hernias

resulting from congenital defects. Although few in number, such hernias assume considerable clinical significance in consequence of the severe degree of acute intestinal obstruction with which they are associated.

Transmesenteric hernias are placed in the group owing to anatomic defects. The hernia which is reported in this paper belongs in a subvariety of this group and was due to a prolapse of the ileum through an aperture in its mesentery. The cause of the aperture in these cases may be either congenital or the result of a thinning of the mesentery with eventual tearing on an inflammatory or a traumatic basis. The great majority of defects in the mesentery of the small intestine are located close to the ileocecal valve although they may be found proximally in the mesentery of the ileum or jejunum. A hernial sac is not present as the intestine merely prolapses through an aperture in its own mesentery.

These patients are acutely ill; the serious nature of their illness may be more fully appreciated from the total mortality of 38 per cent which Cutler and Scott[1] report in their review of fifty patients having transmesenteric hernias but which were not associated with pregnancy. The recognition that acute, intestinal obstruction is present is far easier than the making of an exact etiologic diagnosis. Cutler and Scott state that the specific diagnosis was never made correctly before laparotomy in any of their reported cases. Consideration of the problem emphasizes that there is little to differentiate the presence of an incarcerated, transmesenteric hernia from other types of serious intraabdominal pathologic conditions.

The superimposition of an acute internal herniation upon an existing pregnancy produces an interesting, complex diagnostic problem which is difficult to unravel in the preoperative period. The recognition that an acute abdominal catastrophe has occurred must, of course, lead to laparotomy and the mechanical correction of the difficulty. The pregnancy should not be a deterrent factor in treatment and the reaction of a state of watchful expectancy.

A situation similar in many respects to the one which is to be reported in this paper was reported by Rochard[6] and treated by Morestin. The patient was a twenty-nine year old, white female who, four years prior to the episode reported, had an attack of abdominal pain which was attributed to appendicitis. At this time, surgery was not performed. One year later, the patient became pregnant and was delivered normally. She subsequently became pregnant again and, as she drew near to term, she exhibited many of the symptoms and signs of eclampsia; however, undergoing a spontaneous labor, she was delivered normally of a living infant. Shortly after delivery, the patient complained of abdominal pain; nausea and vomiting occurred and became persistent. Morestin saw the patient about twenty-four hours after delivery. At that time, her abdomen was distended and a tumor was palpated to the left of the umbilicus in the midline. The tumor was round, mobile, tender and tympanitic to percussion. Morestin thought that an intestinal obstruction due to a volvulus was present and advised immediate laparotomy. At operation, he found that a loop of small intestine had passed through a hole in its own mesentery and then had undergone volvulus. The volvulus was easy to untwist and after enlarging the aperture, through which the small intestine had prolapsed, Morestin was able to effect complete reduction. Resection of the involved portion of the bowel was not necessary. The patient made a good recovery.

CASE REPORT

The patient was a married, white female, aged thirty who was seen early in pregnancy. She stated that she had had severe pain of sudden onset in the right lower quadrant of the abdomen for about five hours. Nausea and vomiting of a marked degree were present. The patient stated that she had never had any such attacks previously. Abnormalities of urination had not been present. The menstrual history was interesting in that the patient missed her

last period which should have occurred six weeks prior to the onset of her illness. Vaginal bleeding had not been noticed since her last period and she had never been pregnant before. A detailed review of the other systems did not contribute anything of importance to the history.

Her temperature was 98.2°F., the pulse rate, 72 per minute and the respiratory rate, 14 per minute. Physical findings of a positive nature were limited to the abdomen. Peristalsis was not seen and a mass was neither seen nor palpated; a moderate degree of muscle spasm was present over the entire abdomen. Direct and rebound tenderness were present in all quadrants of the abdomen being most marked in the right lower quadrant. External hernias were not present. Bimanual vaginal examination revealed the cervix to be normal; a marked degree of tenderness was present in the right lateral fornix and a moderate degree in the left. Similar findings were found upon rectal examination.

The erthrocyte count was 3,870,000 per cu. mm, the value for hemoglobin 76 per cent and the leukocyte count 21,900 per cu. mm. of which 90 per cent were found to be polymorphonuclear neutrophilic leukocytes. Urinalysis revealed a trace of sugar but the remainder of the examination was within normal limits.

It was quite evident that the patient had suffered some acute abdominal accident of an unusual nature. The insult to the peritoneum had been great and precipitous as evidenced by the short duration of the illness, the physical findings and the leukocyte and differential counts. The situation presented was not that of the usual case of acute appendicitis. Considered among the preoperative diagnosis was some type of internal hernia, volvulus and, in view of her menstrual history, a right, ruptured, tubal, ectopic pregnancy.

In any event, immediate laparotomy and abdominal exploration were in order. The abdomen was opened through an incision in the right rectus abdominis muscle. Upon opening the peritoneum many coils of gangrenous ileum, which were twisted upon themselves, were found. At first view, it was thought that a simple volvulus of the terminal ileum was present but an attempt at untwisting the bowel was fruitless. The base of the knot was completely visualized and the bowel was seen to have prolapsed through an aperture in the mesentery of the ileum from the upper to the lower side. The aperture was about 2 cm. in diameter and about 30 cm. from the ileocecal valve.

The involved area of small intestine was irrevocably gangrenous. Reduction of the hernia was not done since it would have been extremely difficult and without ensuing advantage if accomplished. The conservative procedure and the one of choice was exteriorization and resection of the involved area; therefore, the cecum and a small portion of the ascending colon were mobilized. The right ureter and ovarian blood vessels were visualized and not injured. The mesentery of the involved area of the ileum was severed below the aperture of herniation until an area supplying viable small intestine was reached. This procedure necessitated the resection of about 130 cm. of ileum. The denuded area was recovered with peritoneum and the small and large intestines prepared for subsequent union by suture of the two loops in a side-to-side position. The ileum, cecum, appendix and that portion of the ascending colon which were to be removed were then brought out of the abdomen and a three bladed Rankin clamp applied. At this time, gentle palpation of the uterus revealed it to be soft and slightly enlarged. The adnexal tissues on both sides were normal.

Two Penrose drains were placed and brought out through a stab wound in the right flank. The exteriorized portions of the small and large intestines were placed at the upper end of the incision and the peritoneum and the anterior layer of fascia of the rectus abdominis muscle were sutured. The skin at the upper and lower angles of the wound was then approximated by interrupted dermal sutures. Large curved hemostats were placed on each end of the exteriorized area, just above the Rankin clamp, and the affected portions of the small and large intestine resected. Powdered sulfathiazole was then placed around the area of amputation.

The course and treatment of the patient, subsequent to operation, were not unusual. Parenteral fluids and vitamins were administered, gastric suction was employed and a transfusion of citrated whole blood was given. Adequate amounts of sulfathiazole were also given. On the second day after operation, an opening was made in the ileum just below the Rankin clamp and a catheter was inserted and secured by two purse-string sutures. This pre-

vented contamination of the wound for several days. Subsequently, the catheter came out and the Rankin clamp came away spontaneously. The spur between the proximal and distal loops was crushed in preparation for closure of the ileocolonic stoma. This was accomplished successfully at a later date. A Friedman test for pregnancy was done during the early part of the hospital stay of the patient and was reported as positive. This confirmed the preoperative suspicion of pregnancy and accounted for the soft, enlarged uterus found at operation. The patient had a normal ante partum course later being delivered of a living male.

Four years have passed since this patient was subjected to surgery; in the interim she has remained well. A mild diarrhea was noted during her early convalescence and this has persisted irregularly to the present. Recently, a barium enema was administered and a roentgen study of the colon was done. This revealed a normal pattern of the mucosa of the colon and the present terminal ileum with the operative defect described previously.

The operative procedure of choice when the involved area is in the lower ileum and cecum is simple exteriorization and resection. Restoration of intestinal continuity should be deferred until a later date. Exteriorization can be performed fairly rapidly with a minimal of trauma to a patient who is already seriously ill and unable to withstand prolonged surgery. Cutler and Scott report a mortality of 20 per cent in five patients with resection of the Mikulicz type. This figure stands in favorable contrast to a mortality of 35.2 per cent in seventeen patients in whom resection and primary anastomosis was done. If the proximal portion of the ileum or jejunum is effected, it may be necessary to do a resection with primary anastomosis.

Treatment of the pregnancy itself should be entirely conservative. Abortion or miscarriage may ensue but the treatment of the pregnancy should be conservative and entirely along general surgical principles unless complications which threaten the life of the mother develop. Then evacuation of the uterus must be given serious consideration.

SUMMARY

Acute intestinal obstruction appearing during pregnancy is uncommon. An internal hernia producing acute intestinal obstruction is rare. A patient who was early in pregnancy and who suffered an internal hernia was successfully treated surgically and was later delivered of a normal, living male.

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PRIMARY MALIGNANT MELANOMA OF FEMALE URETHRA

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MALIGNANT melanoma of the female urethra has been reported at very infrequent intervals and the total number of cases in medical literature is small enough to make an added case of some interest. Its infrequency is well illustrated by the fact that the Mayo Clinic had only three cases to report from 1907 to 1945. During this period 700,000 female patients were examined and seventy-seven primary carcinomas of the female urethra were found, of which only three were primary melano-epitheliomas.

The nomenclature of this pathologic entity is somewhat confusing since there is still some difference of opinion as to the theory of origin of malignant melanomas. There are those who consider it a sarcoma, and there is also the school that considers it of epithelial origin, hence a melano-epithelioma. We believe that malignant melanoma is of epithelial origin and is usually derived from a pre-existing nevus.

In 1896, Reed reported the first authentic case of primary melano-epithelioma of the female urethra. Since then or approximately within a period of fifty years, thirteen other cases were reported.

The disease is manifestly one of old age, the average age of the collected cases being sixty-four years. The youngest patient, reported by Kyrle in 1940, was thirty-two years of age and the oldest was seventy-eight, reported by Long, Counseller and Dockerty. In Kustner's case the age was not given. The age of the patient in this case report is seventy and has been included in the computation of the average. The patients usually complain of vaginal discharge, bleeding and urinary symptoms such as frequency and burning. Urinary obstruction is an unusual symptom.

Grossly the tumor appears pigmented and varies in shade from black to blue with a tendency to spread by superficial lymphatics or through the blood stream. Metastases are widespread and this consequently greatly enhances its deadliness. They frequently are first noted under the skin where they arrange themselves as small, fine nodules which may or may not be pigmented. Malignant melanomas of the eye spread by the blood stream and not through the lymphatics.

Histologically, the cells may be elongated and spindle-like so as to give the impression of fibrosarcoma. In other instances and most frequently, the cells are arranged in an alveolar grouping which strongly suggests an epithelial tumor. The cells are usually large, clear and polyhedral with a large vesicular nucleus and a pale cytoplasm. One section of a slide may impart an impression of carcinoma, another of sarcoma and still another of endothelioma. Mitotic figures are usually in evidence.

The treatment of malignant melanoma is uniformly and consistently unsatisfactory. Surgical excision usually suffices to eradicate the local lesion. However, it is not long before it recurs elsewhere by fatal metastasis. X-ray and radium therapy have been equally disappointing. Handley recommended radical excision with the neighboring glands and intervening lymphatics. In malignant melanoma of the female urethra this obviously cannot always be done.

Newell and Schrivner report a case in which the growth was removed ten times. It was cauterized with actual cautery five times, implantation of 50 mg. of radium directly into the urethra for eight hours on four different occasions and deep x-ray therapy (200 KV) on one occasion. In each instance the growth recurred within two or three months.

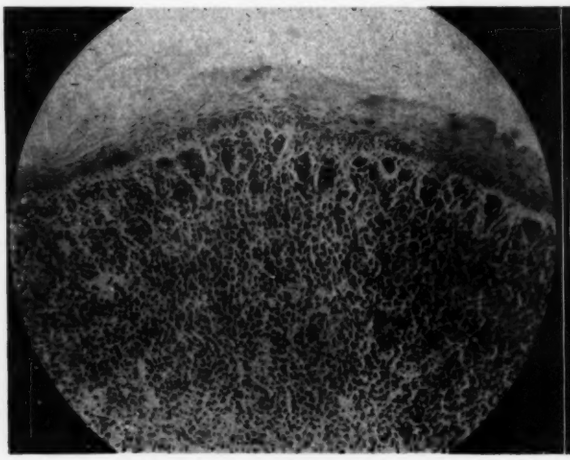

FIG. 1. Low power magnification of tissue removed from urethra at operation.

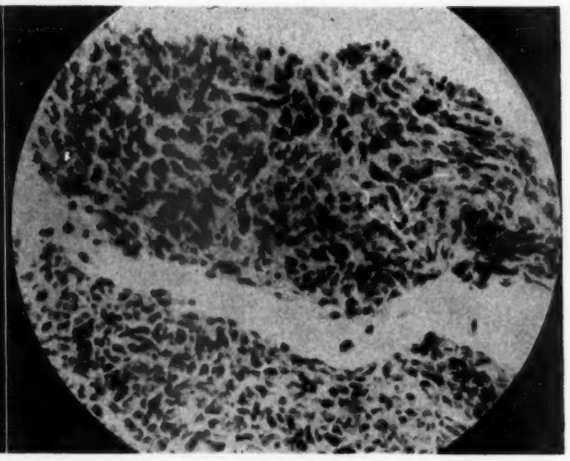

FIG. 2. High power magnification of tissue removed from urethra at operation.

CASE REPORT

On March 5, 1942, a seventy year old female patient (J. D.) was admitted to the hospital with the chief complaint of bleeding from the vagina. Her family and past history was irrelevant except for the history of three operations for "vaginal tumor" in 1933, 1929, and 1925. These operations were done in a physician's office and no record could be obtained.

About two months prior to admission, she began to complain of vaginal bleeding and burning and general discomfort which was aggravated and exaggerated during micturition. She had frequency and nocturia. The bleeding and pain became more pronounced with the passage of time.

Physical examination was essentially negative except for a bright red and hemorrhagic appearing mass which was found protruding from the urethral orifice. The mass was cauliflower in appearance and bled easily on pressure. It was approximately the size of a filbert nut.

At operation the mass was excised from the posterior urethra and the bed sutured. At this time it was noted that the mucosa of the urethra was bluish in appearance. Bleeding was easily controlled and an inlying catheter was inserted.

The immediate postoperative course was quite uneventful and she was discharged from the hospital in five days much improved. She was seen on several occasions and seemed to be quite well.

The report of the pathologist (C. E. Schradieck) follows: "The specimen consists of two tabs of tissue of soft consistency and of dusky-livid color designated as caruncula urethralis. Each piece covers an area of a square centimeter and is of about ½ to ¾ cm. in thickness. Both pieces are somewhat lacerated. The surface appears somewhat granular and papillary.

"In part, the growth is covered with cutaneous epidermis. The papillae of the underlying stroma are distended with densely crowded round and polyhedral cells. The stroma between these cell groups is scant and, owing to edematous and in part hemorrhagic infiltration, is not clearly outlined. The cells infiltrating it show scant cytoplasm and rounded dark staining nuclei. A few show granules of brownish pigment (melanin). Some such cells are also seen within the basal layer of the epidermis. Mitotic figures are practically absent. In some areas these cells are densely crowded but do not appear to form a strictly coherent tissue. Prickle cells were not seen. In other areas the cells are more loosely strewn. Extravasated blood is seen between the cell groups here and there. In some areas a few of the cells contain melanotic pigment but most of them do not. A few pigmented chromatophore cells of mesoblastic character were also scattered here and there. The diffusely infiltrating manner of growth, the irregular sprinkling of it with chromatophores and melanoblasts, the polymorphic character of the cells which are in some areas short spindle and in others more aplastic agglomerations of rounded and polyhedral cells are suggestive of malignant melanoma. These cells are quite densely apposed on the whole and loosely strewn through the stroma in other areas with peritheliomatous grouping about thin-walled blood

vessels or about lymphatic spaces. The above, together with the diffuse penetration of the subepidermoid stroma, convey the impression of malignant melanoma, originating apparently from nevus tissue within the excised area." (Figs. 1 and 2.)

About one year later, subcutaneous nodules became palpable and visible in the inguinal regions and on the abdomen. There was no evidence of local recurrence. These nodules were dark blue and brown in appearance, and were slightly tender upon palpation. Ophthalmoscopic examination of the fundi showed the usual changes associated with senescence. After July, 1942, direct contact with the patient was lost due to the fact that one of us (J. S.) entered the Armed Forces. In September, 1942, she was hospitalized at another institution where she was observed for several days and discharged as having generalized carcinomatosis. No biopsies or x-ray examinations were performed at that institution. She expired on October 2, 1942, nineteen months after operation. No autopsy was performed.

The authors are indebted to Dr. B. Earl Clarke for his kindness in preparing the photographs of the microscopic sections.

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LIGATION OF THE INFERIOR VENA CAVA AND OVARIAN VEINS FOR INFECTED ABORTION*

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THE treatment of infected abortion is conditioned by the pathologic picture presented by the patient upon admission to the hospital. Falk's classification[1] of types is very useful: (1) infection limited to the uterine cavity; (2) parametritis; (3) thromboplebitis; (4) abscess of the wall of the uterus; (5) general sepsis; (6) generalized peritonitis; and (7) perforation of the uterus. This presentation is concerned purely with the treatment of a patient with infected abortion with parametritis, thrombophlebitis and pulmonary infarction, a mixed type two and three.

Early diagnosis of pelvic thrombophlebitis is not always easy. Pulmonary emboli furnish definitive evidence of their presence. Recurring, spiking temperatures with chills are also diagnostic but phlebitis with embolization may occur without this characteristic temperature curve. Manual palpation of thrombosed pelvic veins is only an occasional finding when the phlebitis is secondary to an infected abortion commonly masked by a surrounding parametritis. Not infrequently, patients are observed who present evidence of pulmonary emboli secondary to thrombosed pelvic veins due to abortion without any abnormal findings on pelvic examination. The author would also like to emphasize the possibility of a low grade pelvic peritonitis with few or no clinical signs; conversely, hypogastric tenderness and mild spasticity may be produced by parametritis without gross peritonitis.

Therapy for pelvic thrombophelbitis of uterine origin has run the pendulum of surgical and non-surgical approaches. The latter relies primarily upon chemotherapy and transfusions to sterilize the lesion. Cures of proved pelvic thrombophlebitis with embolization have resulted under this regimen. The more radical school operates on the well established theory that ligation or excision of involved veins prevents venous dissemination of infection. The operative treatment of the patient under discussion must be directed at the ovarian veins as well as those draining the uterus. Nelson et al.[2] found the ovarian veins affected in eighteen of forty-one cases of proven pelvic thrombophlebitis. Hysterectomy, leaving behind many thrombosed parametrial veins, is insufficient as a solitary procedure. The internal iliac veins, common iliac veins or the inferior vena cava below the renal veins must be ligated. The author believes caval ligation is technically the easiest and safest of the three.

The transperitoneal approach permits ligation of both ovarian veins and the inferior vena cava through a single incision. The extraperitoneal approach requires bilateral incisions but is much less shocking and is unaccompanied by the postoperative complications attending a laparotomy. The transperitoneal approach was employed in this case because, along with the thrombophlebitis, a low grade peritonitis was suspected for which hysterectomy as well as vein ligation is necessary. This patient developed postoperative complications, avoidable through the extraperitoneal approach. She was a Negro, a race which has a greater tendency to develop adhesive peritoneal reactions to laparotomy. In future cases of this type, it would be more desirable to follow Krotoski's suggestion[3] of staged procedures. He recommended extraperitoneal ligation of the

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inferior vena cava and the right ovarian veins at the first stage and, if symptoms persist, a second stage wherein the left ovarian vein is ligated extraperitoneally. In complicated cases, hysterectomy may be necessary as a third stage.

Collins et al.[2,4] have reported eight consecutive transperitoneal ligations of the inferior vena cava and both ovarian veins with only a single death. Their reports included protocols of three successful cases and of these, only one was a case of thrombophlebitis secondary to infected abortion. This case substantiates their finding that a seemingly radical operation may be performed for this condition with a cure. The author believes, however, that at present, insufficient statistical figures are available to compare surgical with non-surgical therapy for this specific pathologic type of infected abortion.

CASE REPORT

M. S., a twenty-five year old negro nulligravida, was admitted to the Gouverneur Hospital on August 11, 1946. Her past history was negative except for an appendectomy in 1943, followed by intestinal obstruction which required re-operation and lysis of adhesions two weeks postoperatively.

Her menses had always been regular and she had a normal period between April 29th and May 6th. She did not menstruate in June and on July 19th induced abortion by instilling undiluted lysol into her uterine cavity. This was rapidly followed by vigorous bleeding and passage of large clots and tissue. The bleeding persisted for two days to be succeeded by a brownish, foul vaginal discharge. Between July 21st and August 4th the patient suffered mild, lower abdominal pains accompanied by febrile symptoms. Throughout the week of August 4th to August 11th, these pains were overshadowed by severe pain in the right hip which made walking intolerable and it was with this complaint that she entered the hospital.

On admission, her temperature was 104°F., pulse 120 and respirations 18. It was rapidly determined that her symptoms were not produced by intrinsic disease of the hip for passive motion of the thigh in all directions was painless and x-ray of the hip revealed no abnormalities. Vaginal examination disclosed a tender, boggy, slightly enlarged anteverted uterus; the cervix was patulous to the tip of a finger. Both parametrial regions were densely indurated and exquisitely tender. The cul-de-sac was free and the adnexa were not palpable. There was a foul, brownish vaginal discharge. Physical examination of other systems revealed no abnormalities. Laboratory tests indicated that her urine was normal; hemoglobin, 9.5 Gm., white count, 14,000 and Wassermann, negative. The diagnosis of postabortal parametritis was made and the patient was placed on a course of intramuscular penicillin.

On the day after admission, she complained of sudden pain in the right chest anteriorly and expectorated bloody sputum. For the week following admission she ran a stormy course, complaining of recurrent pains in both chests of deep inspiration and expectorating almost frank blood. Her temperature fluctuated between 102 and 104°F., her pulse between 120 and 140, with respirations averaging 24. On August 17th, the patient had a chill and a rise in temperature to 105°F. An x-ray of the chest taken on August 13th, revealed a soft opacity in the right upper lobe field and one taken two days later disclosed multiple areas of opacity over both lung fields. On August 18th, pelvic examination showed an increase in the size of the exudate in the right parametrium along with moderate tenderness and spasticity in the hypogastrium. The diagnosis of thrombophlebitis with multiple pulmonary infarcts secondary to parametritis and possible low grade pelvic peritonitis was made. The patient had received 3,200,000 units of penicillin and 2 pints of whole blood with no beneficial effect upon the course of the disease.

On August 19, 1946, a laparotomy was performed under spinal anesthesia through a left hypogastric paramedian incision. The left approach was used because her two previous operations were performed through right hypogastric paramedian incisions. On opening the abdomen there was an escape of a small amount of clear amber peritoneal fluid. The uterus appeared normal but both broad ligaments were markedly swollen. The pelvic veins were not palpated to avoid dislodging nonadherent thrombi. The posterior parietal peritoneum was incised over the bifurcation of the aorta and the inferior vena cava just

above the bifurcation was bluntly dissected free. No thrombus was found and it was ligated in continuity with a double strand of No. 3 chromic catgut. The incision in the peritoneum was closed with plain catgut sutures. The ovarian vessels were grossly free of thrombus and ligated *en masse* in the infundibulopelvic ligaments. The abdominal wall was closed in layers with No. 1 chromic catgut and silk to the skin. No significant cardiovascular changes were observed during the operation and the patient was returned to the ward with both lower extremities tightly bound with Ace bandages.

Her immediate postoperative course was stormy. On the fourth postoperative date there was an escape of serosanguineous fluid from the wound indicating a deep wound dehiscence. Her abdomen became markedly distended despite Miller-Abbott tube drainage and on the eleventh postoperative day she presented clinical evidence of small bowel obstruction. On August 30, 1946, under spinal anesthesia she was re-explored through the original wound. The deep layers of the wound were found widely separated. The small bowel was markedly distended down to the distal portion of the jejunum where an adhesion between two adjacent loops of bowel produced complete mechanical obstruction with volvulus of a short segment of bowel proximal to it. Numerous other strong adherent bands were found between the abdominal wall and the small bowel. After lysis of all bands the relaxed loops were found to fill as the distended bowel emptied itself. The wound was closed with through-and-through interrupted wire sutures. The patient convalesced gradually and after a short bout of subacute obstruction on September 18th was discharged on September 30th as well.

Within two days after the primary operation of vein ligation, her pulmonary symptoms disappeared and her temperature returned to normal. The day following she developed marked vulvar edema which subsided within three days. Examination just prior to discharge from the hospital revealed slight edema of the ankles without supporting bandages, no gross evidence of superficial collateral venous circulation and no difficulty in walking. X-ray of her chest on discharge revealed completely normal lung fields.

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New Instruments

IMPROVED APPARATUS FOR SKELETAL TRACTION OF THE CERVICAL SPINE

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SINCE Crutchfield first used skeletal traction for the reduction of dislocated cervical vertebrae, it has gained wide acceptance and has marked the beginning of a more sane and successful concept of therapy. Prior to this time traction could be obtained only by the use of a halter, consisting of slings under the chin and the suboccipital region, which, of course, was uncomfortable. With this appliance the patient could rarely tolerate a traction force greater than 5 or 6 pounds which usually proved inadequate to effect the desired alignment. Furthermore, the halter type of apparatus was mechanically unsound. The resultant line of force was intermittently altered by motions of the mandible during eating, drinking, talking or yawning, frequently producing a seesaw type of motion at the site of fracture. Because of the mechanical limitations and its unpopularity with the patients, many surgeons advocated and practiced reduction of the dislocated cervical vertebrae by manipulation under general anesthesia followed by immediate application of an appropriate plaster cast. Just how many spinal cords were severed, contused, or further damaged during this procedure will never be known, but the mortality was so high during this period that a broken neck was almost synonymous with death.

In 1933, Crutchfield introduced the use of ice tongs which he applied to each parietal region. Although he was unable to effect the desired reduction of the cervical vertebrae, he was impressed by the comfort it afforded the patient. Later he modified the ice tongs to a smaller unit that could be placed in the upper eminences of the parietal region which enabled the patient to turn his head freely. By this method of securing skeletal traction he demonstrated by repeated roentgen observations that dislocations of the cervical vertebrae can be quickly and gently reduced by increasing the force. After reduction had been effected he was able to maintain alignment by the use of reduced force for as many weeks as indicated. One was indeed surprised how often the spinal cord was not irreparably injured and how rapidly its function frequently returned when the dislocated vertebrae had been gently and quickly realigned. Skeletal traction used wisely and patiently has eliminated all indications for manipulation of the cervical spine under general anesthesia in order to effect a reduction. Thus a new era of therapy was begun in 1933. Since then, the mortality resulting from dislocations and fracture-dislocations of this region has gradually decreased until now selected patients are considered amenable to treatment to the extent of complete rehabilitation. It is true that no apparatus is any better than the surgeon using it, but a mechanical device for securing traction of the cervical spine has commanded unusual interest because it has made possible a means of controlled therapy attended

by a decrease in mortality and an improvement of end results.

Neubeiser introduced a method of skeletal traction in 1933, which consisted of placing hooks beneath each zygomatic arch and using weights of 6 to 15 pounds. Zelmo, in 1939, reported the use of the same procedure with satisfactory results. Peyton, Hale and French, in 1944, reported the use since 1940 of the same method for securing skeletal traction. They had used maximum weights of 15 pounds and stated that the traction was comfortable and could be applied as long as desirable.

The placing of hooks beneath the zygomatic arches appears to be ingenious and simple but it does have the objection that the traction is produced in a plane anterior to that of the cervical spine. Therefore, patients might exist on whom this method would be contraindicated. McKenzie, in 1935, emphasized the limitation of halter traction and reported the use of ice tongs with a shoulder of ⅛ inch from each tip and a locking device to keep the points fixed. Incisions of the scalp were required for their application. Cone and Turner, in 1937, reported the use of two burr holes in each parietal region which enabled them to tie a wire around the intervening bridge of bone in order to obtain traction. This procedure represents an operation of some magnitude. Barton, in 1938, reported the use of tongs made of rustless steel which required an incision of the scalp for application and which were held *in situ* by shoulders and a turn buckle. He was well satisfied with its performance in affording comfort and securing the desired results. Wright and Wunderly complained also of the inadequacy of the "Glisson sling." They devised an appliance which utilized the upper teeth and the suboccipital region for skeletal traction. Since it required the help of a dentist and considerable time to make the fixtures for the upper teeth, it is evident that this method does not lend itself readily or conveniently to the demands.

Recently the author described an apparatus for producing skeletal traction to the cervical spine which he devised and made while he was in a forward combat area in 1943. The principal material used was duraluminium obtained from the armor plates of destroyed American combat planes. Six separate units were used on twenty patients who were suffering with recent injuries to the upper spine. Once applied it did not require further adjusting. The maximum time that it was kept employed on any one patient was sixteen days. The maximum weight used for traction was 20 pounds although the usual weights were 10 to 16 pounds. In every instance the attending personnel were impressed by the comfort of the patient and the relative simple nursing care required. Since the earlier experience, an improved type of equipment has been used on six patients. The alteration consists principally of new stainless steel pins with points that will not penetrate the dura even if they should extend a few mm. beyond the inner table of the cranium. Furthermore, this portion of the pin has two flat borders so that traction against the bone of the skull may be transmitted by a flat surface and not by a cutting or round one. This renders the osseous density of the cranium capable of withstanding greater force transmitted through each pin. Also another stopguard has been added to permit the surgeon to have a choice. The larger stopguard is usually preferred for long flat heads while the smaller one is frequently used if the cranial contour is more oval.

A photograph and description of the parts and accessories of the apparatus are represented in Figure 1.

To attach the appliance to the cranium the surgeon and the assistant should wear sterile gloves but they may dispense with the usual scrubbing procedure. As the moving of a patient suffering with a fracture of the cervical spine entails considerable danger and discomfort, it is sometimes preferable to apply the apparatus wherever he may be and then move him while traction is being made. A sandbag is placed

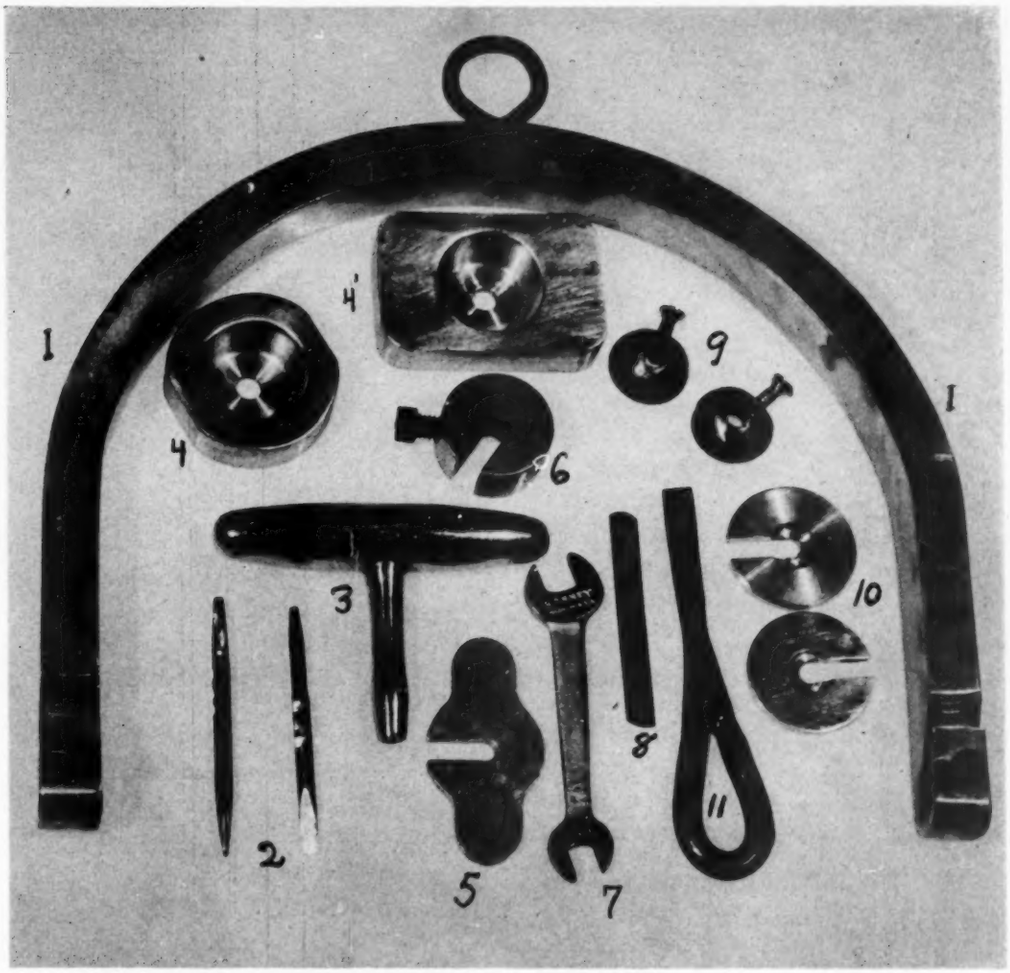


FIG. 1. Parts and accessories of the apparatus. (1) The duraluminium horseshoe frame has a width of 7 inches, a ring fastened to the toe and a slot in each heel. (2) Each stainless steel pin has a perforating type of point with bevelled shoulders recessed $\frac{3}{8}$ inch and a square head. There are three notches on the shaft to indicate the flat surface. The head is square to fit a T wrench. (3) T wrench (stock production, 4 & 44′). Choice of two stopguards made of duraluminium. Each has a concave base to fit over the scalp and a bore to allow for the wheal caused by an injection of procaine solution. (5) Depthmeter which is $\frac{1}{8}$ inch thick to be used for adults and $\frac{1}{16}$ inch thick to be used for children. (6) Guard with slot and set screw. (7) Wrench. (8) Ordinary glass file. (9) Hemispherical anchor with set screw. (10) Scalp plate with slot and concavity on one side. (11) Screw driver.

beneath the occiput, and an area of the scalp 4 cm. in diameter is shaved over each parietal eminence and cleansed according to a standard technic. At a point 3 cm. above and 1 cm. posterior to the pinna of the ear approximately 3 cc. of procaine solution is injected into the scalp and the pericranium on each side. The head of the pin is fitted to the T wrench, and the point is inserted through the stopguard, through the center of a piece of gauze 3 cm. in diameter, into the puncture wound of the scalp made by the needle used for injecting the procaine solution, and passed through the soft tissues until the cranium is encountered. (Fig. 2.) The depthmeter and guard are now applied about the pin in that order. All are pressed firmly against the scalp while the guard is secured by the set screw using the wrench. By means of a file a mark is made on the pin for the purpose of detecting any slipping of the guard should it occur. The depthmeter is now removed and by rotation the pin is in-

serted into the cranium until the stopguard checks the progress. The three notches of the shaft should be left facing toward the dome of the scalp indicating that the flat surface of the point will bear the force of traction. The wrench, guard and stop-guard are removed, the hemispherical anchor threaded over the pin with its convexity toward the scalp and the assistant holds the pin *in situ* until the procedure is repeated on the other side. The slots of the duraluminium horseshoe frame are then placed about the pins and secured firmly by the set screws. The scalp plate is placed against the gauze and the hemispherical anchor is slid into its concavity forming a universal joint, thus permitting the plate to lie firmly against the scalp regardless of the shape of the skull. A rope is tied to the ring, led over an adjustable pulley and the desired weights are applied as shown in Figure 2.

The only hazard associated with applying the apparatus is the possibility of inserting the pin through the inner table of the cranium. This cannot happen unless the guard slips. One can be aware of this occurrence by observing the mark which has been made on the shaft. Furthermore, when the recessed shoulders strike the outer table of the cranium it is very difficult to force the pin deeper. Even if the pin should penetrate the inner table for a few mm., the point is so designed that the dura will be depressed and not penetrated as demonstrated on a cadaver. A little experience will convince one that this possible hazard requires only moderate caution and it should not constitute a fear. If the patient is under fourteen years of age, the depth-

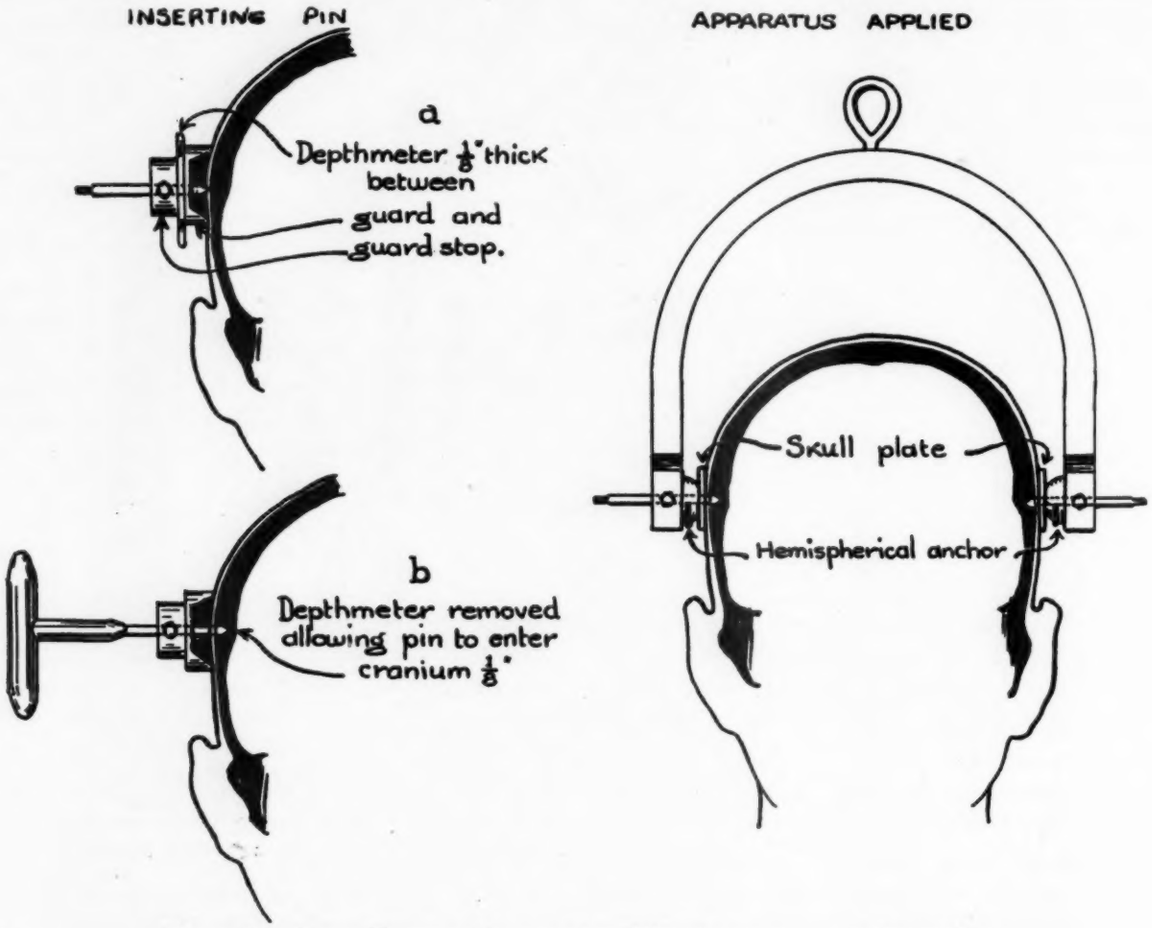
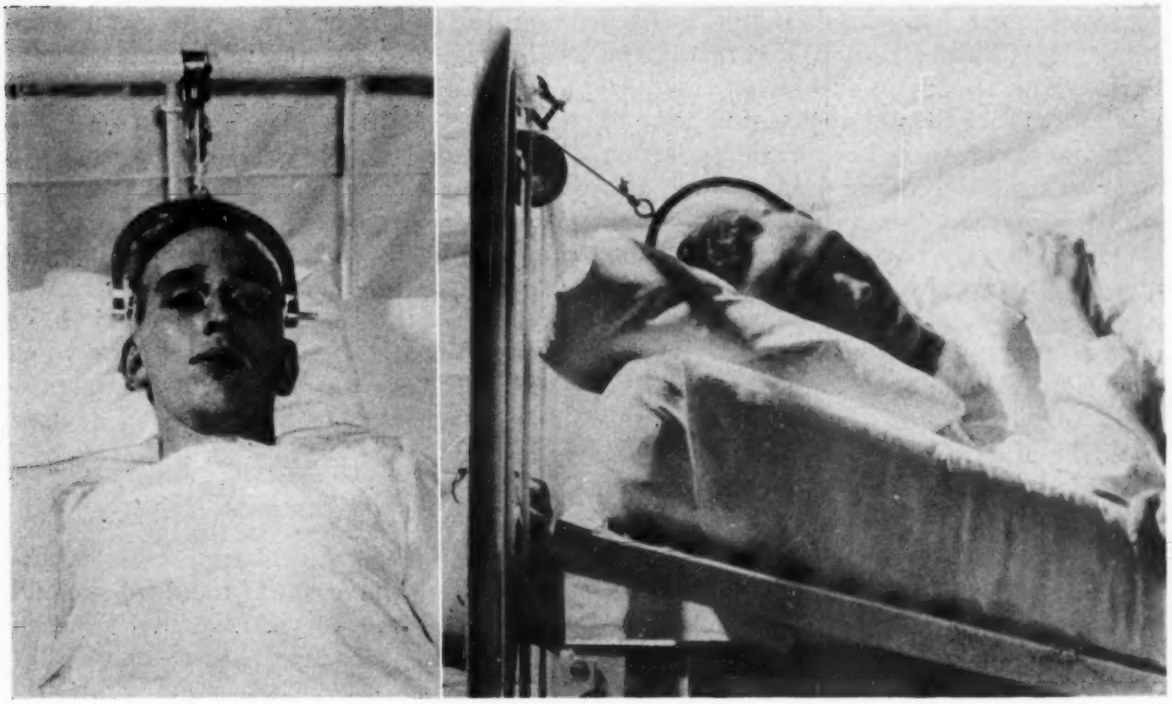
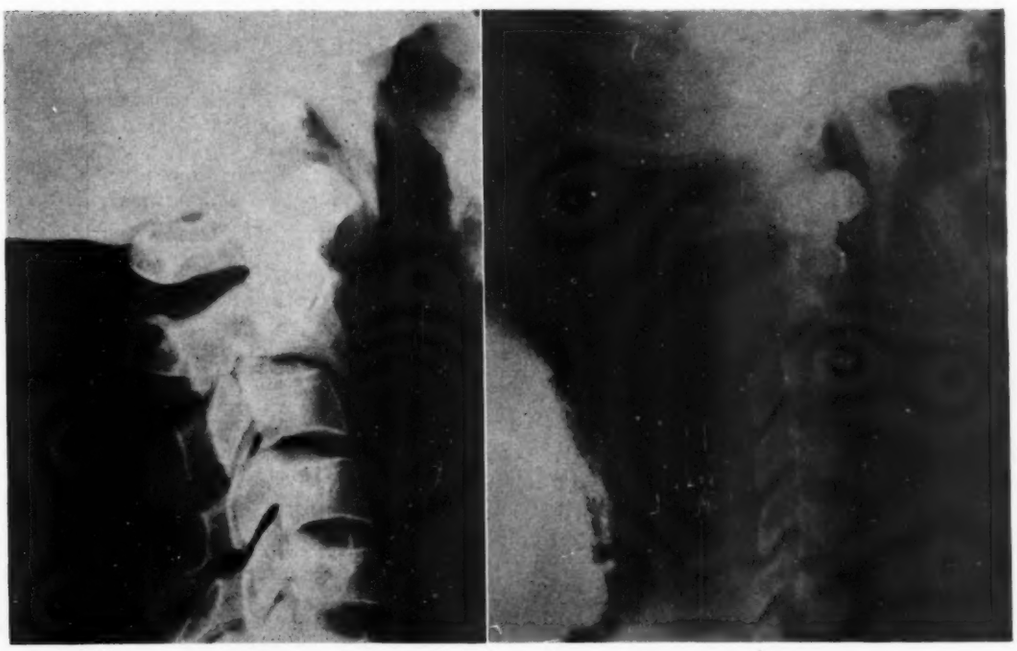


Fig. 2. Drawing to illustrate the steps of applying the apparatus to the cranium.



A B

FIG. 3. Apparatus in use. A, patient in supine position; B, patient lying on right side.



A B

FIG. 4. A, anterior dislocation of first and second cervical vertebrae on the third with right pedicles locked; six weeks' duration. B, reduction and alignment effected by skeletal traction using 35 pounds force.

meter of 1/16 inch thickness should be used rather than that of 1/8 inch. Figures 3A and B show the apparatus in use. In this particular instance the pulley is stationary and the adjustments have been made by raising or lowering the mattress frame which also affords a method of countertraction.

One of the six patients treated by this revised apparatus had been injured about six weeks previously. There was an anterior dislocation of the first and second cervical vertebrae onto the third with the right pedicles locked. The apparatus was applied and a traction of 20 pounds proved inadequate to effect reduction. The weights were increased until 35 pounds were used for six hours on each of two consecutive days during which time the patient was watched carefully and x-ray studies were made at frequent intervals. After the first two hours of each day he complained of tired, aching pains in the cervical region that required codeine and aspirin. When unlocking of the pedicles had been accomplished, the weights were reduced to 12 pounds; they were kept applied for thirty days. (Figs. 4A and B.) The patient spent the remainder of his convalescence in comfort. He stated that he was unaware that there was any traction on his neck except at times when he would forget himself and attempt to sit up. When the patient was ready for a plaster cast, the apparatus was detached simply by loosening the set screw of each slot of the horseshoe frame. A small piece of gauze saturated with colloidon applied to the resulting puncture wounds of the scalp afforded adequate surgical dressings.

It appears that traction to the cervical spine afforded by the various appliances attached to the cranium is more or less identical. All fixtures have withstood a force in the plane of the cervical spine adequate to accomplish the purpose. Therefore, the apparatus of choice would depend upon its familiarity to the surgeon, the comfort to the patient, the ease of application, the lack of hazard to the intracranial contents, the security of the attachment and the amount of adjusting required while it is kept *in situ*.

The horseshoe type of apparatus with little variation (Fig. 1) has been used on twenty-six patients. After the first few hours it has been comfortable. It has fulfilled the requirements of the criteria mentioned, to the extent that it may have earned consideration for its adoption when the surgeon is confronted with the particular problem for which it has been devised and made.

CONCLUSION

A horseshoe type of apparatus for attachment to the cranium to afford skeletal traction of the cervical spine has been described and used satisfactorily on twenty-six patients. It has been comfortable, required no incisions of the scalp, remained firmly attached to the cranium without further adjusting and produced no injury to the intracranial contents.

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TRACHEAL AIRWAY FOR USE DURING TOTAL LARYNGECTOMY*

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DURING performance of total laryngectomy when the trachea has been transected just below the cricoid cartilage, it is desirable that the distal tracheal stump be held out of the way so that no blood enters the tracheobronchial

FIG. 1. Breathing tube for laryngectomy which consists of a tapered angled tube with two detachable ends (large and small). A useful devise to hold the tracheal stump out of the way so that blood will not enter the tracheobronchial tree.

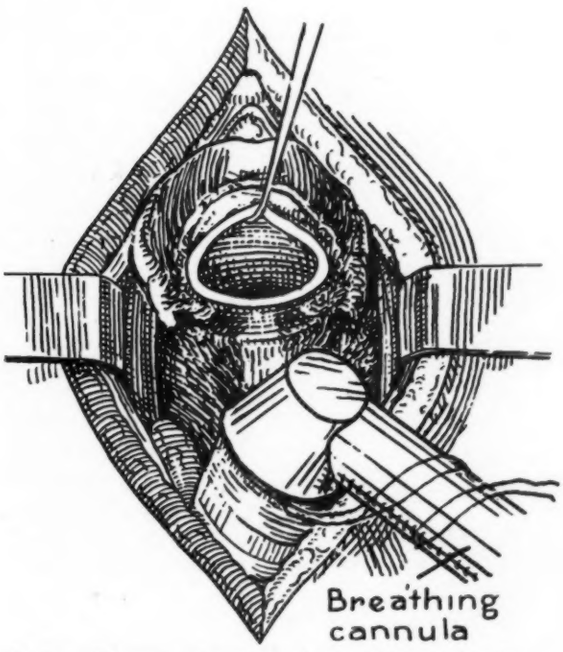

FIG. 2. Diagram showing tube in place during laryngectomy. The trachea is cut across just above its upper ring and the breathing cannula is inserted into the open end of the trachea. Two heavy sutures are passed through the tracheal wall and wrapped around the angled tube to keep it in place.

* From the Head and Neck Service, Memorial Hospital for the Treatment of Cancer and Allied Diseases, New York, N. Y.

tree. This phase of the operation may be particularly troublesome to the patient and annoying to the surgeon, especially when operating on individuals with bleeding tendencies. If the tracheal stump can be plugged with a tapered tube which is bent at such an angle so as not to be in the way of the operator, the safety factor of the surgical procedure is increased and no unnecessary time consumed.

The device shown* in the accompanying diagram consists of a tapered angled tube and is provided with two detachable ends of different sizes, large and small. (Fig. 1.) The tube is held in place by passing a heavy suture through the stump and winding it several times around the tube. (Fig. 2.)

* This instrument is manufactured by and may be purchased from the United Surgical Supply Company

G. Goggi reports two instances of tuberculosis of the thyroid both proven histologically. Both patients also had tuberculous lesions elsewhere. In one, surgery was contraindicated because of advanced osseous tuberculosis and the "acuteness" of the degree of the perithyroid tuberculosis infiltration that was also present. The other woman had a cold abscess in an adenoma of the thyroid, but her general condition was better and her pulmonary tuberculosis was healed. Hence, a partial thyroidectomy was done in her case. *(Richard A. Leonardo, M.D.)*

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	RIBOFLAVIN..... 0.87 mg.	0.24 mg.
	NIACIN ..... 2.3 mg.	1.4 mg.
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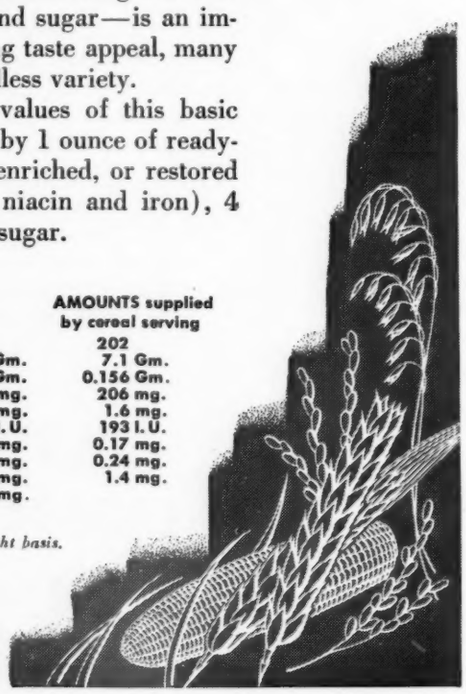
* *Composite average of all breakfast cereals on dry weight basis.*



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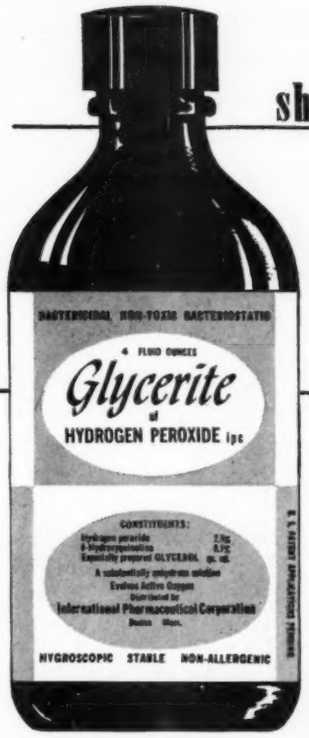

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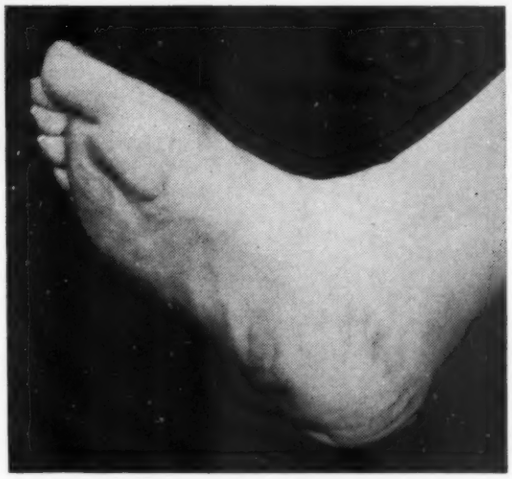

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CADY, J. B. and MORGAN, W. S.	The Treatment of Chronic Ulcers with Chlorophyll	Am. J. Surgery LXXV: 4 (1948)
GAHAN, E., KLINE, P.R. and FINKLE, T. H.	Chlorophyll in the Treatment of Ulcers	Arch. Dermat. & Syph. 47: 849 (1943)
HOLMES, G. W. and MUELLER, H. P.	Treatment of Post-Irradiation Erythema with Chlorophyll Ointment	Am. J. Roentgenol. 50: 210 (1943)
LANGLEY, W. D. and MORGAN, W. S.	Chlorophyll in the Treatment of Dermatoses	Penn. Med. Journal Vol. 51; No. 1 (1947)
MORGAN, W. S.	Chlorophyll Therapy A Review of 114 cases	Guthrie Clinic Bulletin, 16: 94 (1947)

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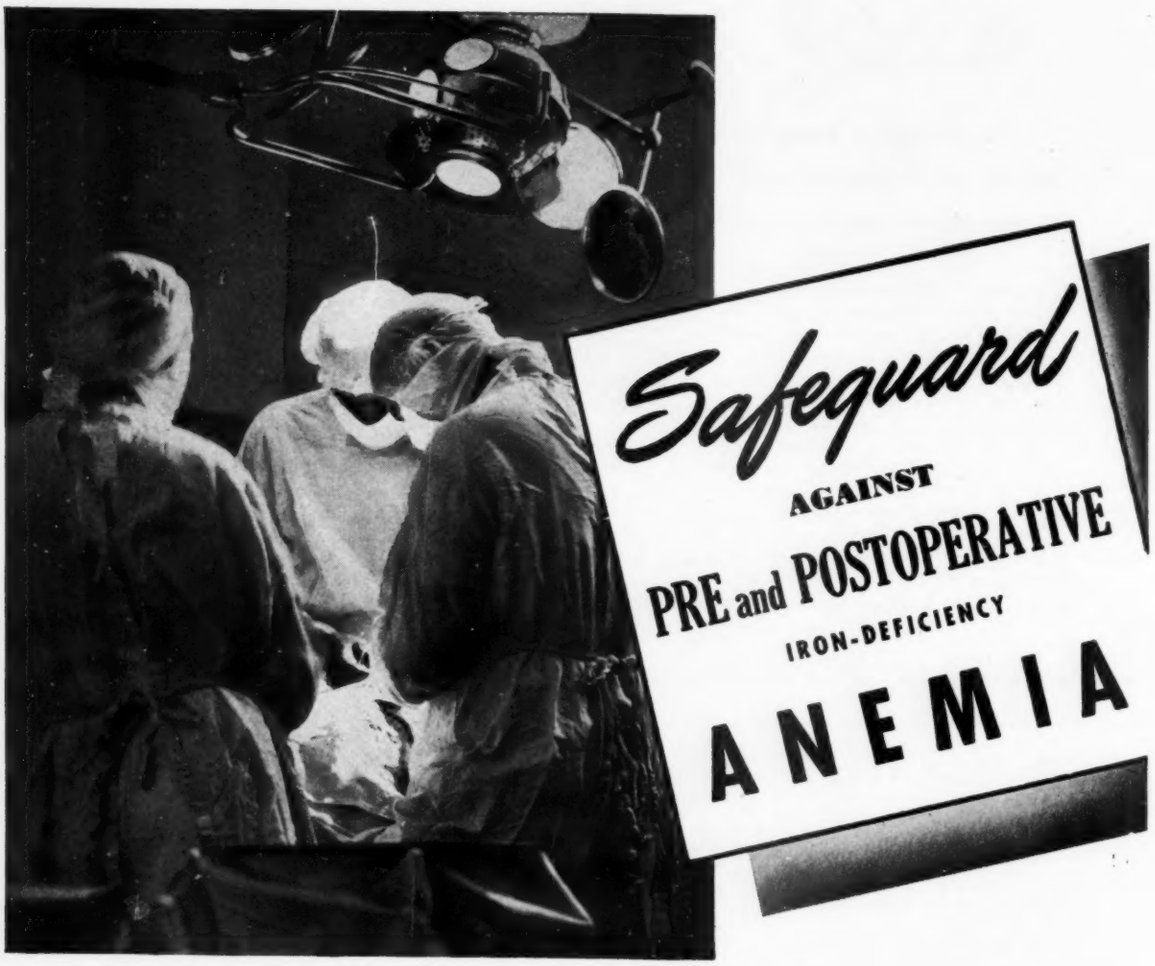

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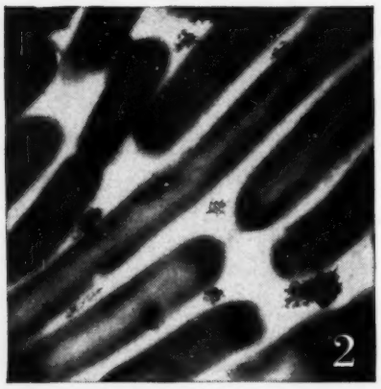

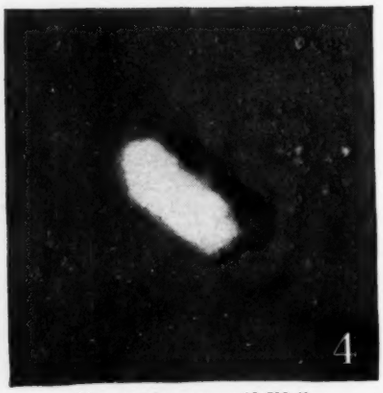

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Double action against K. pneumoniae...with SQUIBB streptomycin

bacteriostatic action of Squibb Streptomycin against *K. pneumoniae* is indicated in the accompanying direct transmission electron micrographs.

1. Normal Friedlander's bacillus. Note normally dividing cells in center of picture.

2. Organisms, after 18 hours exposure to Squibb Streptomycin in a concentration of 0.05 mmg. per ml. Cell growth continues, but normal division has been inhibited. Note enormously elongated cell which extends across four or five microscopic fields. Such cells reach a maximum length and die of old age. Note loss of surface definition in other cells.

bactericidal action of Squibb Streptomycin against *K. pneumoniae*, occurring simultaneously with the bacteriostatic action, is indicated in these electron microscope pictures of shadowcast specimens.

3. Normal Friedlander's bacillus coated with gold to give relief by the shadowcast technique.

4. Friedlander's bacillus after 18 hours exposure to Squibb Streptomycin in a concentration of 0.05 mmg. per ml. Cell wall shows advanced disintegration. Cytoplasm appears to have erupted through hole in cell wall and to have spread over partially collapsed cell, which is probably dead.

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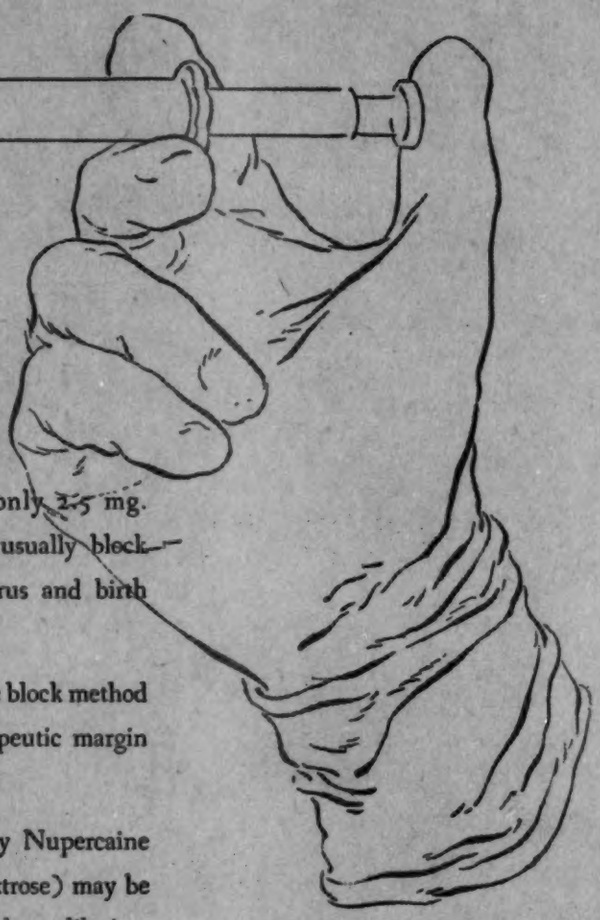

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